

THE
SURGICAL CLINICS
OF
CHICAGO

AUGUST, 1919

VOLUME 3—NUMBER 1
WITH 117 ILLUSTRATIONS

PHILADELPHIA AND LONDON
W. B. SAUNDERS COMPANY

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PUBLISHED SIX MONTHLY (SIX NUMBERS A YEAR) BY W. B. SAUNDERS COMPANY, WEST WASHINGTON
SQUARE, PHILADELPHIA.

PRINTED IN AMERICA

CONTRIBUTORS TO THIS NUMBER

ARTHUR DEAN BEVAN M D Professor of Surgery at Rush Medical College in Affiliation with the University of Chicago Surgeon to the Presbyterian Hospital, Chicago

BENJAMIN FRANKLIN DAVIS M D, Assistant Attending Surgeon Presbyterian Hospital Chicago Instructor in Surgery Rush Medical College Chicago.

DANIEL N EISENDRATH M D Clinical Professor of Surgery Rush Medical College Chicago Attending Surgeon Michael Reese and Cook County Hospitals Chicago

DR. GATEWOOD Instructor in Surgery Rush Medical College Chicago.

HERMAN L. KRETSCHMER, M D Urologist, Presbyterian Hospital Chicago Assistant in Genito-urinary Surgery Rush Medical College Chicago

DEAN LEWIS M D Associate Professor of Surgery Rush Medical College Chicago Attending Physician to the Presbyterian Hospital, Chicago Consulting Surgeon to the Anna Durand Hospital for Contagious Diseases Chicago Lieutenant-colonel Medical Corps U S Army

HUGH McKENNA M D Senior Surgeon and President of Staff, St Joseph's Hospital, Chicago Associate Professor of Surgery (Extramural) Rush Medical College Chicago

GOLDER LEWIS McWHORTER M D Instructor in Surgery Rush Medical College Chicago

KARL A. MEYER, M D Assistant Professor of Surgery University of Illinois.

W F MONCREIFF M D Assistant in Surgery University of Illinois.

EDWARD LOUIS MOOREHEAD M D Surgeon to Mercy Hospital Chicago Adunct Clinical Professor of Surgery Northwestern University Medical School.

CLIFFORD C NESSELRODE M D Attending Surgeon St Margaret's Hospital, Kansas City Kansas Associate Professor of Clinical Surgery, University of Kansas School of Medicine Kansas City Kansas Major Medical Corps, U S Army

FRANK A NORRIS, M D Captain Medical Corps United States Army U S Army General Hospital No 28 Fort Sheridan Illinois

ALBERT J OCHSNER M D LL D Surgeon in Chief Augustana and St Mary's Hospitals Chicago Professor of Clinical Surgery in the Medical Department of the State University of Illinois.

EDWARD H OCHSNER M D Attending Surgeon Augustana Hospital Chicago

D B PHEMISTER, M D Associate Attending Surgeon Presbyterian Hospital, Chicago Major Medical Corps U S Army

LEWIS J POLLOCK M D Major Medical Corps U S Army Assistant Professor of Neurology Northwestern University Medical School, Chicago Attending Neurologist Wesley Hospital Chicago

CHARLES F REED M D Obstetrician to Wesley Memorial Hospital Chicago

RUDOLPH S REICH, M D Captain Medical Corps, U S Army, Assistant in Orthopedic Surgery Mt Sina Hospital Cleveland Ohio Orthopedic Service U S Army General Hospital No 28 Fort Sheridan Illinois

THEO ROTHSSTEIN M D Professor of Neurology Rush Medical College Chicago

EDWIN WARNER RYERSON M D Professor of Orthopedic Surgery Chicago Polyclinic Assistant Professor of Surgery Rush Medical College, Chicago Orthopedic Surgeon to Children's Memorial Hospital and Home for Destitute Crippled Children Chicago Major Medical Corps U S Army

KELLOGG SPEED M D Assistant Professor of Surgery Northwestern University Medical School Surgeon Mercy Hospital Chicago Surgeon to Provident and Cook County Hospitals Chicago

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SURGICAL CLINICS OF CHICAGO

Volume 3

Number 4

CLINIC OF LIEUT COL DEAN LEWIS

U S A GENERAL HOSPITAL No 28, FORT SHERIDAN, ILLINOIS

PERIPHERAL NERVE SURGERY

Summary A series of cases illustrating the common results of injury to peripheral nerves and the method of choice for the correction of each condition

NUMEROUS problems are presented in peripheral nerve lesions. Cases of compression by scar tissue and bony callus, partial and complete anatomic interruptions in which suture can be easily performed, and cases of complete division with loss of substance, in which many different methods of repair have been attempted without any great degree of success, are encountered.

CASE I—The first patient upon whom I shall operate was wounded on October 1, 1918, in the Argonne. He sustained a gunshot wound of the left arm and another of the right side of the jaw. These wounds were caused by fragments of high explosive. The wound of the jaw was followed by hemorrhage into the neck causing compression, for the relief of which tracheotomy was performed. The wound of the left arm, the scar of which you see, was not a perforating wound, and the fragment of high explosive was so superficial that it could be picked out of the wound with tissue forceps. This fragment fractured the humerus, although it did not reach the bone.

Immediately after the patient was struck he noticed that he was unable to extend the wrist. Inability to extend the wrist has persisted up to this time. There is no marked atrophy of the extensor muscles on the back of the forearm, but the patient is unable to extend the wrist or fingers, and when such an attempt is made the fingers are flexed. The patient is unable to

found a dissociated sensory syndrome, and the sensory changes are localized to the small area in the web between the thumb and index finger on the dorsal side

Palpation of the musculospiral nerve fails to reveal a neuroma, although the musculospiral nerve can be palpated in the groove for a considerable distance. The absence of the neuroma and the presence of a compression syndrome would warrant one in making a diagnosis of physiologic rather than anatomic interruption. The physiologic interruption has lasted so long that one is justified in exposing the nerve for the chances of spontaneous recovery of function are practically nil.

I will expose the nerve by an oblique incision over the course of the musculospiral nerve, extending from above and backward, downward, and forward on the posterior and outer side of the arm.

The scar of the previous wound is avoided as the scars resulting from gunshot wounds are apt to slough if an incision is made which separates them from the underlying tissues.

As the dissection is made down to the musculospiral groove little or no scar tissue is encountered. This case differs in this very markedly from a number of cases in which the scar tissue was very dense.

As the musculospiral nerve is exposed at the lower end of the musculospiral groove it is found to be compressed by a very delicate piece of connective tissue (Fig 257). The constricting band is circular and the diameter of the nerve is reduced almost one-half by this delicate constricting band. It seems almost as if a fine suture had been tied about the nerve at this point. As I divide the constricting band and lift the nerve out of its bed I am struck by the fact that there is no anatomic change in the nerve except the reduction in diameter by about one-half. The constricted area is, however, soft, and on the proximal side of the constriction no neuroma is found. There is no circumferential change in the nerve at any point. It is quite evident from these findings that we are dealing with a case of simple compression. The diagnosis of nerve compression which was made clinically corresponds to the changes found at operation.

The only thing required in an operative way is division of the constricting band. In order, however, to avoid the recur-

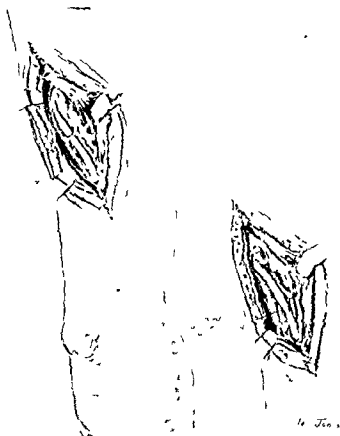


Fig. 257—Complete physiologic interruption of left musculospiral nerve due to a delicate constricting band following a penetrating wound by a piece of an explosive shell. In this case there was also a fracture of the humerus. Excision of the scar followed by muscle neurolysis was performed. First evidence of return of motor power noted in ten days.

rence of a constricting band I shall perform neurolysis, an operation of very distinct value in cases of this kind.

The nerve is lifted out of its bed, for the constricting band

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nerve proximal to it. The circumference of the nerve must have been reduced one half at the point of constriction. This patient should make a complete recovery.

Note—Ten days after this operation was performed there was noted a decided return of motor power in the muscles supplied by the injured nerve. Voluntary movements were noted in some of the muscles supplied by it. Four weeks after operation the patient had good control of the extensor carpi radialis longior and brevior. The action of the extensor communis digitorum returned much more slowly.

CASE II—This patient was wounded August 8, 1918, at Fismes. He received a perforating gunshot wound of the lower part of the left thigh at that time. The wound of exit is found directly to the outer side of the external popliteal nerve at a point just below the middle of the popliteal fossa. Immediately after this wound was received the patient noted that he was unable to raise the foot. This foot-drop has persisted ever since the injury was received. There is some atrophy of the anterior tibial group of muscles and the reaction of degeneration and anesthesia such as occurs normally with divisions of the external popliteal nerve.

When the external popliteal nerve is palpated a nodule is found just above the scar caused by the foreign body. When pressure is made upon this nodule the patient complains of a tingling sensation which radiates into the foot. This radiation corresponds to the distribution of the filaments of the external popliteal nerve in the foot.

With these clinical findings there can be no doubt but that we are dealing with an anatomic division of the external popliteal nerve.

In making the incision to expose this nerve which passes along the inner border of the biceps tendon it will be prolonged downward in a curve on to the anterior surface of the leg so that the distal segment of the nerve may be mobilized if there is any difficulty in making an end to end suture.

When the nerve is exposed a bulbous end—a distinct neuroma—is found on the distal end of the proximal segment. This

which held it has been cut away. In order to avoid the possibility of recurrence of compression the nerve will be placed in a new bed.

Numerous methods of performing neurolysis have been proposed, such as surrounding the nerve with Cargile membrane, free or pedunculated fat transplants, or formalinized calves' arteries, etc. In this case the dissection has been made as nearly as possible along the intermuscular septum, and an attempt will be made to perform what may be called a muscle neurolysis. In any operation upon injured nerves the dissection should be made, when possible, along intermuscular septa, because hemorrhage is thus avoided and when the operation is completed the freed nerve, or the suture line, providing suture has been performed, can be placed in a bed between muscle fibers which have not been injured. The recurrence of adhesions is thus avoided. In this instance the triceps muscle can easily be sutured under the nerve and the outer border of the biceps can be sutured over it. When this operation is completed the nerve lies comfortably in a new bed. Little hemorrhage has occurred. What has occurred has been easily controlled, and I do not believe that we need fear the formation of new adhesions about the nerve.

Neurolysis has a distinct place in nerve suture. Hashimoto, operating upon the wounded in the Russo Japanese War, had considerable experience with Foranitt's method which consisted of surrounding the freed nerve or the suture line with calf's artery hardened in 10 per cent formalin. Such an artery causes little or no reaction in the surrounding tissues. I prefer, however, to use neighboring muscles for this purpose, and in the majority of cases muscles adjacent to the injured nerve can be used. When muscle cannot be used for this purpose, a free fat transplant may be employed.

The pathology in this case is exceedingly interesting. The physiologic interruption of the nerve has been caused by a very delicate circular band of scar tissue. In spite of the constriction which has lasted for some months there has occurred no gross anatomic change in either the compressed segment or in the

nerve proximal to it. The circumference of the nerve must have been reduced one half at the point of constriction. This patient should make a complete recovery.

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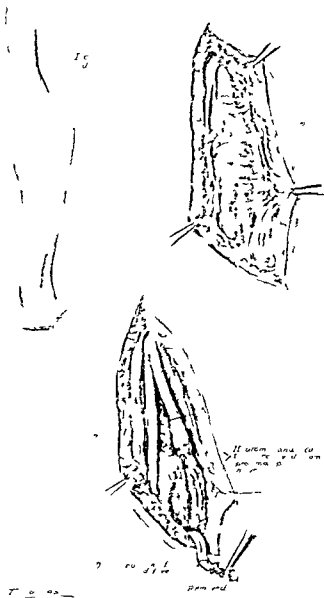


Fig 258

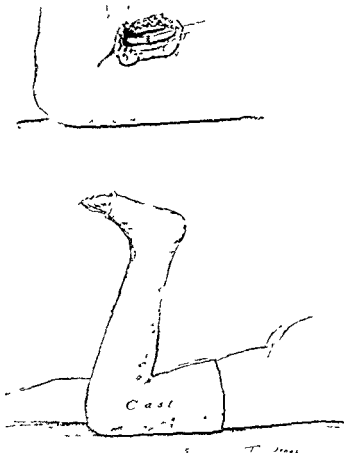


Fig 259

Figs 258, 259—Complete anatomic division of external popliteal nerve. Resection of scar tissue from both ends of nerve until healthy neurofibrillæ were exposed. End to end suture of nerve after knee is flexed to a right angle. Fixation in a plaster of Paris cast is maintained for four weeks. At the end of this time gradual extension of the knee is begun.

bulbous end is connected with the proximal end of the distal segment, from which it is separated for some distance by a band of cicatricial tissue

The ends of the nerve with the intervening scar tissue are dissected free, apparently the two ends can be easily brought together when the scar tissue is resected. The ends are cut away with a small sharp knife—a safety razor blade may be used for this purpose—in order to avoid trauma. The nerve ends are resected until healthy neurofibrillæ herniate from the ends of the nerve. Scar tissue interferes with nerve regeneration and one of the commonest causes of failure of regeneration is insufficient resection of nerve ends. It is difficult in some instances to determine how much of the nerve ends should be resected. In many cases neurofibrillæ are seen after the ends are resected but these are matted together and appear edematous. In some instances this condition of the neurofibrillæ is associated with thickening of the epineurium. When such is the case three or four longitudinal incisions should be made in the epineurium for I believe that this edema and matting of the neurofibrillæ is the result of a circulatory change due to constriction by thickened epineurium.

When the knee is flexed the ends of this nerve can easily be brought together without tension. Flexion to an angle of 10 degrees suffices. I prefer fine black silk sutures prepared with carbolyzed beeswax for uniting the ends of the nerve. Five or six sutures will suffice to approximate the ends. These are passed through the epineurium after hemorrhage from the ends of the nerves has been controlled. These sutures are not tied tightly. The ends of the nerves are merely approximated no attempt being made to force them together. When these sutures are carefully and accurately applied the cut edges of the epineurium of both nerve ends will be coapted and there will be no bulging of neurofibrillæ outside the line of suture. A circular suture of the epineurium has been recommended. I believe that it is not necessary. The fewer sutures the better and with the number which I have inserted the nerve ends can be accurately approximated (Figs 258 259)

A plaster-of Paris cast will be applied to the leg with the leg in flexion. This position will be maintained for four weeks after which the cast will be removed and the leg gradually extended. In some cases in which a greater space exists between the ends and suture is made with greater difficulty fixation must be maintained for a longer time.

CASE III.—This patient presents a painful lesion of the hand. This painful type of lesion was described by Weir Mitchell in the Civil War and was called *causalgia* by him. The term is derived from the Greek word *καω* meaning I burn. Caustic has the same derivation. A burning pain is the symptom of which these patients complain most bitterly.

This patient was wounded July 17, 1918, at Château Thierry. A machine gun bullet passed through the left arm midway between the shoulder and elbow, fracturing the left humerus. The wound was debrided and healing occurred. For a short time there existed a musculospiral paralysis but this has gradually disappeared.

This patient now complains bitterly of a burning sensation in the hand. The burning is so intense that the patient goes frequently to the cold water tap and holds his hand under it. At times he will wrap the hand in a towel soaked with cold water or wear a glove which has been soaked. The condition of these patients is well described in Benisty's book as follows:

The incessant pain which dates from the early months of the injury and which never ceases even at night suddenly increases owing to causes which the unfortunate patient delights in describing in the minutest detail.

An attack is usually brought on or prolonged by bending the hand down so patients always keep it up. Exposure to air, dry heat, particularly a hot atmosphere, noise, sudden and bright light, deep breathing, coughing, sneezing, and laughing have the same effect. Emotional causes soon come into play such as the sight of a wide open expanse, an empty space, looking out of a window or descending a staircase, meeting a relative, the doctor's visit—in fact any emotion is said to increase the pain. Then the condition becomes aggravated, the

patients can no longer bear to see their fellow patients play or to hear them laugh because they are afraid of an accident. A comrade walking across a polished floor on crutches, the sight of anyone leaning out of a window, a workman on a roof the flight of an aeroplane, or anything that suggests the possibility of a fall or giddiness intensifies the pain."

This patient has a distressed facial expression. He is melancholy and wishes to be let alone.

When the hand is examined there is no definite paralysis. The limitation of motion which is present is due to fear of increased pain if the hand is moved. The fingers are thin and tapering the skin white shiny, and atrophic. The skin is dry, there being no perspiration but the dryness is not so marked that the skin chaps and scales off.

The patient holds his elbow flexed. The wrist is curved inward. The hand is raised and the fingers extend. In some cases the terminal phalanx may be hyperextended.

These symptoms are probably the result of an ascending neuritis. In causalgia of the hand the median nerve is the one usually involved in causalgia of the foot the internal popliteal. We have here in the hospital a causalgia of the lower extremity in which some of the pain has been relieved by alcoholic injection of the internal popliteal nerve but a burning pain still persists over the distribution of the long saphenous.

There is another case of causalgia of the hand in which a machine gun bullet injured both the median and musculo-spiral nerves. There is practically no paralysis in this case and the burning pain is not associated with any trophic changes. The pain in this case is aggravated on a hot day. The symptoms appear like those of causalgia but I do not believe them severe enough to require injection of the nerve.

The case under consideration is so severe that relief from the pain is imperative. I will expose both the ulnar and median nerves. Both of these are bound down in scar tissue but they are easily freed. In the case of the median the most marked pathology is found at the entrance to the antecubital fossa. The median nerve is usually the seat of an ascending neuritis in

these cases and I shall inject it with 60 per cent alcohol which at most will cause but temporary paralysis (Fig 260) The patient will recover the use of the muscles supplied by the nerve injected as soon as he would without for the pain following



Fig 260 Injection of 60 per cent alcohol into the median nerve to cure causalgia following injury and central compression of the median nerve

movement would inhibit use of the muscles for that length of time anyway

x Ray treatment of these lesions has been advocated Leriche removed the periarterial sheath of the sympathetic in a case of lesion of the brachial plexus and the pain was greatly relieved

These patients are greatly relieved by alcoholic injection and this is such a simple procedure that it should be attempted. These cases tend to recover spontaneously. In six months the worst period has usually been reached and from then on there is gradual improvement. During this period care should be exercised that contractures do not develop.

CASE IV.—This patient was wounded August 31 1918 while standing in a trench shooting over a parapet. The machine gun bullet entered below the coracoid process on the right side and ranging downward and outward made its exit at the middle of the axillary border of the scapula. Immediately after the bullet struck there was complete paralysis of the hand and forearm on the right side. A history of suture of the ulnar nerve five days after the injury is given. There has been gradual return of musculospiral nerve function on this side. The patient has no record with him of what operative procedure has been employed but there has been no improvement in sensory or motor function for so many months that an exploration of the nerve is justified. There are distinct evidences in this case that the principal vessels of this extremity have been severed. These evidences are decided vasomotor changes. The hands are blue or rather bluish red. In most of the cases that we have observed in which there have been vasomotor disturbances there have been injuries of the vessels. The location of the wound would indicate that an injury to the principal vessels might easily have occurred.

I will expose the plexus in this instance by a long incision which parallels the groove between the deltoid and pectoralis major muscle. These muscles are separated but to better expose the lower part of the cords of the brachial plexus the tendon of the pectoralis major will be divided at its point of insertion. When this is divided the seat of the lesion comes into view for there is a large amount of rather dense scar tissue in which the nerves are undoubtedly embedded.

In order to avoid traumatism of the nerves and to facilitate the dissection the nerves will first be exposed in the arm and traced upward. These nerves are easily found below in their

normal relations. It is a general principle of surgery of this type that all dissections should be made over healthy portions of the nerves first where the nerves are found in their normal relations. In this way undue injury to the nerve from extensive manipulation and dissection is avoided.

As these nerves are traced backward toward the axilla rather dense scar tissue is encountered. This should be divided by sharp dissection for traumatism to the nerve is thus avoided.

When these nerves have been freed there is found no interruption in continuity. It cannot be stated from the findings whether or not there has been a division of the ulnar nerve. In the history elicited from the patient there is an indication that the ulnar nerve had been sutured. If it has continuity of the nerve has been established and maintained.

The next thing to be determined is whether or not the median and ulnar nerves should be resected. The nodules or rather somewhat spindle like enlargements on both nerves are soft. They have a slightly yellowish appearance. They neither look nor feel like the hard cicatricial tissue which forms a block to regenerating neurofibrillæ. When there is a possibility that neurofibrillæ will pass through a nerve at the point of injury and neurotize the distal segment resection should never be thought of. If a resection and end to end suture should be attempted any regeneration which has occurred would be lost and besides the results of such an operation may be doubtful. Removal of the scar tissue about these nerves at the site of the injury followed by some procedure designed to prevent the re-development of this scar tissue is all that is indicated (Figs 261-262).

Some of the pectoralis major will be used to place over the rather dense cicatricial bed which has been partially removed in this case. This muscle will undoubtedly undergo atrophy and partial absorption but I do not believe that it will form a heavy scar. The remainder of the pectoralis major is sutured over these nerves after hemorrhage has been controlled.

I do not believe that there is at the site of the lesion in these nerves any block to regenerating neurofibrillæ. Recovery should

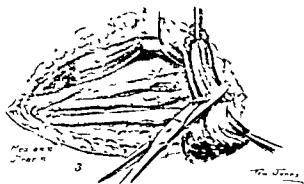
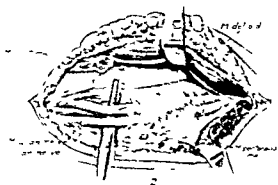


Fig 261

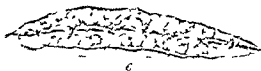
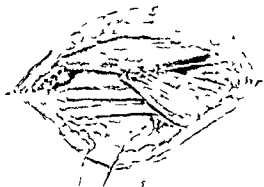
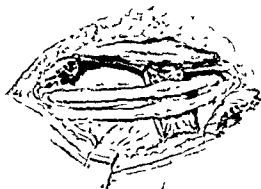


Fig 262

Figs 261 262 —Illustrating steps of freeing median and ulnar nerves in the axilla. Note enlargements of both nerves. These are soft and not due to scar tissue. Resection is not indicated. Whenever there is a possibility that neurofibrillæ will pass through an enlargement of this type resection followed by suture should never be attempted.

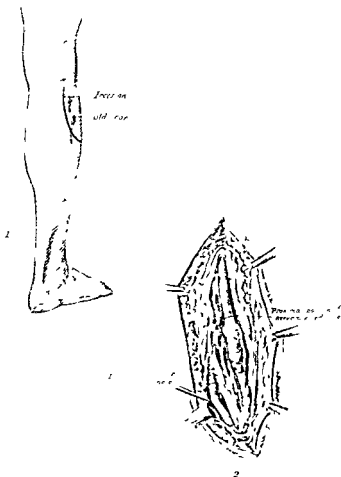


Fig 263



Fig 264

Figs 263, 264—Use of the autograft. A long defect remained after resection of scar tissue. End to end suture was not possible even after flexion of the knee. The autograft in this case was taken from the short saphenous nerve and its communicating branch from the external popliteal nerve.

eventually occur, although it may require some time. During the time in which recovery is occurring every effort should be made to prevent the development of deformities and contractures. Physiotherapy should be employed and dressings applied so that the muscles affected should be in the state of relaxation.

CASE V—This patient was wounded October 19, 1918 in the Verdun sector. He sustained a high explosive wound of the right leg just below the knee on the outer and posterior aspect. The scar which remains after wound healing is found over the outer side of the head of the fibula.

The incision which is employed in lesions of this type is seen in the accompanying figures. The lower part of the incision is curved forward on to the anterior surface of the leg, so that when it becomes necessary to locate the superficial and deep branches of the external popliteal nerve they may be found in their normal anatomic relations.

There has undoubtedly occurred in this case a complete interruption of the nerve. No return of motor function has occurred. There has been no contraction of anesthetic fields. At least no contraction which is at all significant. When the course of the external popliteal nerve is palpated a distinct neuroma is found. When pressure is made upon this a tingling sensation is experienced in the leg and foot of the patient which corresponds to the terminal distribution of the nerve.

After the scar tissue is resected in this instance a long defect remains. The ends of the nerves cannot be united even after flexion of the knee to an acute angle. Nerve transplantation will be attempted.

The communicating branch to the short saphenous is exposed. As it is dissected out it is found to divide into two branches below. This segment of nerve is removed. I prefer to put in several grafts and to perform what is called an autocable transplantation. By spreading out the two branches of the extremity of the transplant I can cover in this case the greater part of the distal end of the proximal segment. The proximal end of the distal segment can also be covered by spreading out by suture the original proximal end of the transplant. I believe

that enough neurofibrille will pass through this transplant into the distal segment to complete neurotization of the distal segment and the motor end plates. This is the result desired (Figs 263-264).

In performing this operation or any nerve operation pinching of the nerve or any undue roughness should be avoided. Mention is again made of this because in the figure too much of the nerve is grasped by forceps.

At the present time only a little over 30 per cent of these cases are being operated upon. If a diagnosis of complete anatomic or physiologic interruption is made an operation is performed.

End-to-end suture is the only operation where anatomic interruption exists which gives any assurance of a high percentage of recoveries. An attempt should always be made to secure an end-to-end union. Even when there are long defects this can be done by posture.

The procedure which should be attempted when end-to-end suture cannot be performed is nerve grafting. An autograft should be used—an autocable transplant being inserted.

Neurolisis is an operation which must be performed often. Muscle neurolisis is much preferable to any other type.

Careful and diligent after treatment is required in these cases. Treatment in almost all cases has just begun when the operative procedure has been completed.

CLINIC OF MAJOR C C NESSELRODE

GENERAL HOSPITAL NO 28, FORT SHERIDAN, ILLINOIS

CLOSURE OF CRANIAL DEFECTS BY OSTEOPERIOSTEAL GRAFTS TAKEN FROM THE TIBIA

Summary The 'trephine syndrome' demonstration of a case cure of syndrome by closure of cranial defect technic of operation choice of material for transplantation advantages of bone over cartilage

IN connection with the cases showing cranial defects there has arisen a definite syndrome or symptom complex, known as the "trephine syndrome." This is characterized by, first, a sensation of emptiness in the trephined area, second, unpleasant sensations, such as vertigo or nausea on stooping or other sudden changes of position. When the patient is in the upright position there appears in the site of the trephine a definite depression, when he bends over a hernia is seen to appear in the same place. These continuous movements of the brain disturb the patient. Third, these patients cannot tolerate external vibrations, such as the moving of a train, the shaking of an automobile, etc. These patients, as a rule, are unable to tolerate the movies because of the constant flicker of the film. Fourth headache and other symptoms of meningeal irritation due to adhesions between the meninges and the cicatrix present in the trephined area.

The trephine syndrome disappears almost entirely after a properly performed plastic operation on the skull, but any concomitant organic lesion that may be present is in no way directly benefited.

A case of hemiplegia will take its usual course, the patient obtaining merely the suppression of the irritable cortical symptoms through the cranial plastic operation. This is easily understood and if there is present any organic lesion this fact should be explained to the patient.

Chutro gives it as his opinion that all loss of substance from the skull, both small and large, should be closed by a graft. He also gives it as his opinion that cranioplastic operations cause the disappearance of all of the principal signs of the trephine syndrome. The last to disappear is the vertigo.

Concerning the best procedure for grafting, Chutro prefers cartilaginous graft. He states that except in a few fortunate cases the plates of foreign matter, such as metal, ivory, celluloid, or dead bone, are cast out at the end of a certain time. As to the choice between dead and living grafts, there is no longer any doubt of the latter being preferable.

The advantages claimed for cartilage are the ease with which it is procured and also the ease with which it is cut and bent to fit the cranial defect. Personally we prefer the tibial transplant, feeling that thereby we are restoring the skull more nearly to normal.

In illustration of the preceding statements I present the patient G. H. S., private, Co. C., 55th Inf. Teamster. American by birth. White.

Family History—Father, good health, aged fifty-five. Mother, good health, aged sixty. Two brothers and two sisters living and well. One sister died at the age of thirty-two following childbirth.

Early History—Measles at age of ten, mumps at twelve, small pox at sixteen.

Past History—Negative except for accidental loss of left thumb August, 1916.

Habits.—Occasional glass of beer. Uses tobacco moderately.

Present History—On September 26th went into action with 4th Division at beginning of Argonne-Meuse offensive, and on October 4th was struck on right side of head by a piece of high explosive, size of palm of hand. Was knocked down and rendered unconscious for a very short period of time. Then assisted to his feet by a comrade and walked half a mile to edge of woods. There he sat down and as he says, soon fell asleep, and remembers nothing more except the injection of antitetanic serum and the shaving of his head until two days after the operation.

which was done on October 6th at Evacuation Hospital No. 4. The record shows that at operation there were removed several pieces of foreign bodies and numerous pieces of detached bone leaving a large cranial defect over which the scalp was closed. The record available does not indicate an injury to the brain and we conclude there was none as the patient has never suffered any paralysis or convulsion. The wound was healed at the end



Fig. 265.—Defect in parietal region before operation.

of a month. He remained in bed until about December 10th. On December 16th was started from Base Hospital No. 52 on his journey home which he made with many interruptions.

Arrived at General Hospital No. 28 on February 28, 1919. Physical condition on arrival at hospital. Well nourished weighed 175 pounds.

Special senses. Normal. Pupils react to light and distance. Skin and mucous membranes. Clear.

Glandular system. No enlargement of superficial glands.

Chutro gives it as his opinion that all loss of substance from the skull, both small and large, should be closed by a graft. He also gives it as his opinion that cranioplastic operations cause the disappearance of all of the principal signs of the trephine syndrome. The last to disappear is the vertigo.

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In illustration of the preceding statements I present this patient G H S, private, Co C, 58th Inf Teamster American by birth. White.

Family History—Father, good health aged fifty five. Mother, good health aged sixty. Two brothers and two sisters living and well. One sister died at the age of thirty two following childbirth.

Early History—Measles at age of ten, mumps at twelve, small pox at sixteen.

Past History—Negative except for accidental loss of left thumb August, 1916.

Habits—Occasional glass of beer. Uses tobacco moderately.

Present History—On September 26th went into action with 4th Division at beginning of Argonne Meuse offensive, and on October 4th was struck on right side of head by a piece of high explosive, size of palm of hand. Was knocked down and rendered unconscious for a very short period of time. Then assisted to his feet by a comrade and walked half a mile to edge of woods. There he sat down and, as he says, soon fell asleep, and remembers nothing more except the injection of antitetanic serum and the shaving of his head until two days after the operation.

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Fig. 265.—Defect in cranial region before operation.

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Arrived at General Hospital No. 28 on February 28, 1919. Physical condition on arrival at hospital. Well nourished, weighed 175 pounds.

Special senses. Normal. Pupils react to light and distance.

Skin and mucous membranes. Clear.

Glandular system. No enlargement of superficial glands.

Vascular system Pulse full, soft, regular

Blood pressure Normal

Heart Normal, no murmurs, no arrhythmia

Lungs Normal

Abdomen Normal Soft and well formed

Nervous system Reflexes present and normal, no paralysis or other evidence of involvement of nervous system



Fig. 266—x Ray of skull defect prior to operation

Osseous system Large defect of skull in right parietofrontal region Defect is kite shaped measuring $5\frac{1}{2}$ inches in its extreme length and $3\frac{1}{2}$ inches in its extreme width Its long axis is at right angles to the longitudinal sinus which is crossed by the longer arm of the kite shaped defect to the distance of 1 inch in the line of the coronal suture At the site of the defect is a marked depression when patient is in upright position but a hernia cerebri on stooping (Figs 265 266)

Muscles and joints All normal and active

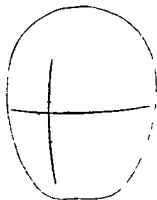
Diagnosis on transfer card Gunshot wound of right parieto frontal region

Fracture of skull with large cranial defect

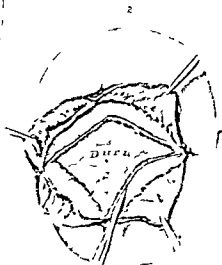
The patient complains at this time of dizziness on change of position some headache and blurring of vision He is markedly depressed refusing to take any part in ward conversations but keeps to himself at all times Is very sensitive and concerned about his head and wears his hat to hide the pulsating defect

Operation —Our incision follows the scar of the previous operation and turns the flaps back in the four directions (Fig 267 1 2) from a common point in the center of the depression Great care is taken in dissecting the scalp from the underlying dura not to open the dura The flaps having been reflected sufficiently to expose the free bony edge of the cranial defect throughout its *entire circumference* we next make an incision through the periosteum on the outer surface of the skull about $\frac{1}{4}$ inch external to the free edge (Fig 267 2) From this we reflect the periosteum inward and downward leaving the free edge entirely denuded of its periosteum (Fig 267 3) We now free the dura periosteal layer from the inner surface for the distance of $\frac{1}{2}$ inch This is done with great care not to rupture the same and expose the cortex of the brain The object in freeing the periosteum is not only to free the bone edges of fibrous tissue but also to form a pocket into which the edges of the graft may be inserted

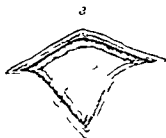
The bed for the graft is thus completed and we now turn to procuring the graft It is well to take measurements first and have in mind the exact place the graft is to be placed before it is cut In this way one can save much material and in a case as extensive as this one it is always a question of where to get enough grafts Our first graft will be 4 inches in length and somewhat pointed at one end and is to close the arm of the cavity extending down lateralward the mesial end to be interlocked beneath the shoulder extending from the anteromesial border The graft is outlined on the face of the tibia then cut with a rotary saw to the depth of $\frac{1}{4}$ inch and separated from underlying bone with a thin sharp chisel Since it is a convex surface that is to be closed



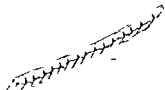
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2



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4 5 6

the graft must be bent. To accomplish this it is necessary to cross cut the graft in many places with the rotary saw. One cuts from the fresh side of the graft through nearly to the periosteum (Fig 267 4). This carefully done gives you a graft which is easily bent yet is sufficiently strong and still has an intact periosteum. With the first graft in place a second is planned, marked out and cut exactly the same as the first and so on until the entire defect is closed with grafts which fit exactly. In this case we cannot get enough grafts from the one tibia and it will be necessary to open the second one. It requires in all eight grafts varying in length and shape according to the space each is to close (Fig 267 6). Care is taken to see that the ends of the graft fit securely into the space between the periosteum and the denuded free edge of the cranial bone. A cross section is shown in Fig 267 5. For the purpose of illustration the dura and periosteum are shown as two layers. One prefers to place the periosteal side of the graft inward that is periosteum to dura but in this case it is necessary to place some of them in the reverse manner because of the great size of the defect and the difficulty in securing enough grafts. With the grafts accurately in place the scalp flaps are closed without drainage and a paraffin gauze dressing applied. The incision over the tibia is closed by my assistant while I close the scalp wound. Casts are applied to the leg and the patient returned to his bed in fair condition.

During ten months Villandre personally operated on 106 cases of loss of cranial substance. The procedures employed were

- 1 Cartilaginous cranioplasty
- 2 Osteoperiosteic grafts taken from the tibia
- 3 Sterilized bone plaques
- 4 Paste composed of carbonate and phosphate of lime for small breaches

The author indicates the various types of lesions in which

Fig 267—1 Incision for exposure of defect. 2 Defect exposed incision for exposure of raw bone surface at margin of defect is partially completed. 3 Defect ready to receive transplants. 4 Method of cross cutting graft to render it malleable. 5 Cross section showing relations of graft when properly placed. 6 Grafts in place the next step will be the closure of the scalp wound.

these methods are used. The statistical results of the four procedures were as follows:

Osteoplastic grafts 32 successes in 32 cases or 100 per cent.

Cartilaginous cranioplasty 46 successes in 48 cases or 96.8 per cent.

Sterilized bone plaques 18 successes in 22 cases or 81.8 per cent.

Lime paste 2 successes in 4 cases or 50 per cent.

A graft of living substance—bone or cartilage removed from the patient himself and at a distance from the site of the loss of substance is therefore the most practical and the surest method of repairing a loss of substance. Such reparations are relatively without danger when they are made by a surgeon operating under rigid conditions of asepsis. Of 106 cases operated upon there was not a single death.

Free bone flaps and is more frequently to be employed displacing inorganic materials which have been formerly relied upon. The method of free grafts dates from the experience of Ollier in 1865.

The advantages of bone-graft over metal and celluloid plates are:

1. The bone live and eventually becomes part of the skull.
2. It does not cause irritation or act as a foreign body.
3. An excellent effect is produced on the patient mentally.

Bone has the advantage over cartilage in that it retains its hardness and is as efficient a covering for the brain as the skull. Leriche and Policard have recently reported upon microscopic examination of cartilage implanted to close cranial openings: the one case operated thirty-six days and the other one year previously. The cartilage proper in both cases had disappeared and been substituted by connective tissue.

Gilmour of Toronto working in a Canadian Hospital at Orpington, England, reports that in 2 of his cases in which he used cartilage examined after five months the graft had softened and did not give the same amount of protection as did bone.

He wishes to draw especial attention to the following benefits from operative procedures to close cranial defects:

- 1 Depression leaves, the patient becomes optimistic and bright
- 2 Headaches improve in all cases, entirely disappear in most cases
- 3 Memory improves dizziness disappears
- 4 Eyesight improves the blurring of vision disappears, and the color fields increase



Fig 208 —Appearance of operated area ten days following operation

5 The patient ceases to be a permanent ward of the state and becomes a useful citizen, capable of carrying on an ordinary occupation

Note —This patient made an entirely satisfactory convalescence Was up in wheel chair at end of the first week, and since the third week has been walking about At the end of the third week the grafts were all firmly healed in place There is no

longer any pulsation. There has been complete disappearance of the "trepaine syndrome." The patient is no longer depressed.



Fig. 269. After operation. Front view showing restored contour of head and is now taking an active part in all ward activities, feeling himself to be entirely well (Figs. 268, 269).

TIBIAL TRANSPLANT FOR UNUNITED FRACTURE

Summary Technic of repair of ununited fracture of both bones of the leg by the Hoglund method

THE patient is D G private 521st Motor Transport, age twenty six white American by birth Previous occupation, farming



Fig. 270—Position of ununited fracture on admission to hospital

Early History—Measles mumps and small pox

Past History—Typhoid at age of twenty appendicitis at age of eighteen

Venereal History—Denied

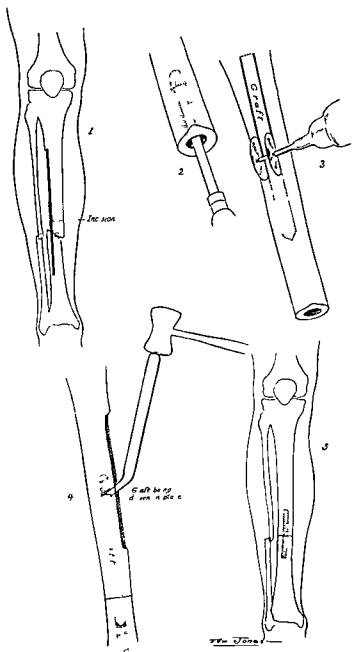


Fig 271

Present History—While unloading crated truck at Bordeaux December 30, 1918 patient fell 15 feet suffering a compound fracture of left tibia and fibula in the lower third also a dislocation (subglenoid) of the head of the humerus left, with fracture of the tuberosity and injury to the brachial plexus

Following reduction of dislocation the injury to the brachial plexus has cleared up with gradual return of both motor and sensory function Patient entered General Hospital No 28 March 28 1919, as a litter patient with fracture of tibia and fibula ununited as shown by accompanying x ray (Fig 270) The wounds to the soft parts of leg have been healed since January but there is no attempt at bone union

Operation—Incision 10½ inches in length is made along crest of left tibia (Fig 271 1) The incision is so planned as to give ample exposure of both upper and lower fragments The ends of both upper and lower fragments are freed and turned out of wound and the marrow cavity of both fragments reamed out to a distance of 2 inches For this purpose we used the reamer at attachment of the Albee motor driven bone outfit (Fig 271 2) In doing this autogenous tibial transplant we are using the method described by Emil Högglund of Chicago This he published in *Surgery Gynecology and Obstetrics* February 1917 and is a most excellent adaptation of the intramedullary graft Having completed the reaming out of the marrow cavities we lay aside our reamer and attach the twin saws The upper fragment being much the longer we cut from its anterior surface a 4 inch graft the lower end of which is 2 inches above the lower end of the upper fragment and the width of which is planned to match the size of the reamed-out medullary cavity (Fig 271 3) The graft is next cut free at its upper and lower ends but not removed The graft is now readily pressed inward so that it occupies the underlying medullary cavity and is ready to be driven downward into the reamed-out portion of the medullary cavity of both upper and lower cavities Before doing this however it is necessary to

Fig 271—1 Incision for exposure of fracture 2 to 5 The bone marrow is reamed out a graft cut from the tibia 2 inches above site of fracture and driven down across fracture line

bring the two fragments into proper alignment. This is readily done by traction. They may be held in proper alignment either by the large bone forceps or by means of a Lowman clasp. The graft which now lies in the medullary cavity of the upper fragment may very readily be driven downward into the position where it bridges the point of fracture (Fig. 271, 4) and extends for



Fig. 272—x Ray after operation. Lateral view showing graft. Fig. 273—Anteroposterior view showing intermedullary graft in place.

a distance of approximately 2 inches into the marrow cavity of both upper and lower fragments (Fig. 271, 5). Hoglund has also devised a special instrument which is of great service in driving the splint downward through the canal across the line of fracture (Fig. 271, 4). The wound is then closed by interrupted sutures and a plaster cast applied to the leg (Figs. 272, 273).

The original feature of this operation is the method of cutting the graft at a distance of from 1 to 2 inches from the line of fracture so as to leave a complete ring of bone at the fractured end thus contributing enormously to the strength of the union. This makes the strongest and at the same time most accurate mechanical fixation of which I know. Its advantages and its ease of application recommend it as the operation of choice in most of the cases of ununited fractures in long bones.

Note —This patient made an entirely satisfactory convalescence. Wound healed by primary intention. At the end of the fifth week on removal of the cast there was complete union. The patient could unassisted lift the leg free from the supporting pillow. A new cast was applied which was left on another four weeks. It is important to keep these bones immobilized longer than would ordinarily be the case because of the atrophy of disuse that is always present in these old fracture cases.

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LEFT INGUINAL FECAL FISTULA

Summary Gunshot wound of rectum with resultant fecal fistulæ in both hips inguinal colostomy for cure of wound fistulæ with resultant permanent fistula in colostomy wound technic of operation for cure of inguinal colostomy

THIS patient is twenty five years of age, single, by occupation a cabinet maker, and American by birth

Family History—Father's age fifty-eight, good health, Mother's age fifty nine Two brothers living, three brothers died in infancy, two sisters living

Early History—Diphtheria at age of nine, many attacks of tonsillitis

Past History—Negative except for double pneumonia in August, 1917 at Camp Logan

Venereal History—Had gonorrhea in 1914

Habits—Occasional glass of beer, tobacco moderately

Present History—On September 26th in Forges Woods near the Meuse River he received a machine gun bullet wound, passing through the pelvis in a lateral direction The wound of entrance was 3 inches back and 1 inch up from the left great trochanter the wound of exit 4 inches directly back from the right great trochanter

Operated October 6th at Base Hospital No 15 Between date of injury and date of operation he had had several hemorrhages from the rectum and fecal matter was being discharged from both wound of entrance and exit The operation was evidently a left inguinal colostomy Following colostomy the left buttock wound closed within six weeks and the right wound closed in about four months but opened again within three weeks Remained open for two weeks and then closed remaining closed up to the time of entrance to this hospital

Entered General Hospital No 28 March 24, 1919 in good physical condition except for ventral hernia at site of operation

for colostomy, with colostomy wound still open discharging fecal matter. Fascial defect giving rise to ventral hernia is 4 inches in length, 1 inch in extreme width. The original perforation which gave rise to the fecal fistula through buttocks evidently was in the rectum and postperitoneal since, from the history, we can get no evidence of the patient ever suffering from a peritoneal infection.

The object to be obtained by previous operation evidently was the creation of a comparatively simple inguinal fistula which would encourage the closure of the two fistulae lower down. In this it was entirely successful.

Operation.—On April 7, 1919, the patient was anesthetized. The fistula was closed with three silk stitches, the operating field then sterilized with benzine, iodine and alcohol. A curved incision following the mesial border of the fascial defect was made, this cleared the intestinal opening by approximately $\frac{3}{4}$ inch. The flap thus freed was turned outward, the peritoneal cavity opened along the same line. All adhesions freed and bowel dissected loose from abdominal wall. The scar tissue about edges of opening closed in the usual manner. The bowel dropped back into abdomen. Peritoneum closed. Abdominal wall closed in layers each layer having been previously dissected free. Muscle edges approximated with No. 1 catgut sutures lightly tied. Fascial layers overlapped, No. 3 catgut suture material being used. Skin closed without drainage. Patient's convalescence was uneventful, he was allowed out of bed during third week. This case is of interest because of the unusual site of the intestinal perforation and resulting fecal fistulae, and the use of the very good idea of an inguinal colostomy to encourage the closure of the fistulae lower down.

CLINIC OF MAJOR D B PHLEMISTER

U S GENERAL HOSPITAL No 25, FORT SHERIDAN, ILLINOIS

REPARATIVE SURGERY OF WAR WOUNDS OF BONE AS ILLUSTRATED BY FRACTURES OF THE FEMUR

Summary Chronic infection long standing malposition and partial or complete interruption of continuity the chief problems to be met the first problem overshadowing all the rest pathologic anatomy of chronic posttraumatic bone infections methods of examination obliteration of dead spaces and removal of sequestra the chief essentials in treatment Dakin's solution playing a secondary relatively non-essential rôle Demonstration of illustrative cases

THE care of the wounded in the hospitals of this country as they have been returned from overseas has presented different problems from those encountered in the earlier work in the same type of cases on the other side

In the case of fractures the important problems arising during the stage of splinting and acute infection about the seat of the fracture have largely passed, as months have usually elapsed since the injury, and healing is either well under way or completed, and well-developed sinuses have been established where infection persists, allowing of discharge of pus and limiting abscess formation to a small percentage of cases

The problems presented are largely those of chronic infection, long standing malpositions, and partial or complete interruption of continuity resulting from loss of bone substance By far the most important of these is persistent infection with its consequent fistulæ and discharge It is the sequel of the acute infection which occurs at the time of the injury, and leads to the formation of a variable amount of dead bone and to alteration in the callus The fractures are usually comminuted, with a number of large or small splinters and sharp irregular, pointed fragment ends Necrosis of the splinters is common especially when

they are completely detached. Frequently only portions of adherent or detached splinters die. Death of the ends of the fragments is apt to occur, especially when pointed, but also along the margins of the oblique fracture lines. Reparative processes soon begin in the surviving elements of the ends of the fragments and splinters, and lead to callous formation which has the usual features of callus formed in the presence of infection and about dead bone. Destructive changes are set up about the dead bone which lead to its gradual separation from the living bone and the formation of a variable number of sequestra. Unless the destruction of osteogenetic elements has been too extensive the newly formed bone usually leads to bony union in from two to five months in case of the larger bones. The pieces of dead bone come to lie in pockets or cavities surrounded by masses of exuding granulations which continue to exert more or less absorptive action on them. If the dead bone is pocketed where the granulations have a better chance for attack the absorption may be considerable and continued irregular reduction in size will occur. But if it lies in larger open spaces and is bathed continuously in the pus of discharging deeper portions, the surrounding granulations will be less healthy and destruction may be very slight, especially in the case of a large dense piece of cortex.

The new bone bridging the fracture is irregular in its distribution according to the location of the dead bone and the cloacæ which form for the escape of the discharge. There are usually one or more cavities, pockets, or windows along the lines of the fracture which have resulted from the formation of dead bone and the failure of the callus to fill out the defect in these regions.

The dead fragments may be gradually broken up, extruded, or absorbed as time goes on, in which event the rigid walled sinuses usually remain and are filled with granulation tissue which contains bacteria and fails to be converted into scar tissue, thus keeping the sinus open. Frequently the cavity is very irregular, extending obliquely along the fracture line with several arms and openings. Tunnel formation is very common from the presence of a cavity in the medullary region with an opening on either side.

The callus as a rule, gradually organizes and does not present evidences of chronic infection after the dead bone has been separated and the sinuses and cavities have been definitely established. Consequently, the main causes of persistent infection with continuous or intermittent discharge in the type of case which is seen months after injury are dead bone and cavity, tunnel and pocket formation at the seat of fracture. More or less disseminated infection of the callus may be occasionally responsible but it plays a relatively minor rôle.

Rational therapy in the old cases is based almost entirely upon the recognition of dead bone and its removal and the presence of abscess cavities, pockets and tunnels and their effacement by the sloping removal of a sufficient amount of the surrounding new or old bone to allow the soft parts to fall in and fill out the space.

It is rare to find either new or old living bone so extensively infected that removal of large amounts for this reason is necessary. Combined clinical and roentgenologic study will usually give one the desired information as to the presence and extent of these conditions and the type of operation can be planned before the bone is exposed. Occasionally both the amount of dead bone and the extent of cavity formation will be far in excess of expectations and a different plan of procedure has to be resorted to after the exploration. The incision or incisions are so placed that periosteum and soft parts are removed as nearly as possible only from that bone which is to be excised. This prevents infection and subsequent death of unnecessarily denuded bone which is left.

If the callus is sufficiently strong to permit of the removal of the dead bone and the effacement of cavities and tunnels at the same operation this is always done but if the removal of the necessary amount of bone would leave a too much weakened bridge and lead to fracture or danger of non union the dead bone alone is removed and the soft parts are

the surrounding soft parts and are not the cause of the fistulae in

marked contrast to the dead bone. This is because they are sterile on the inside and easily become encapsulated while dead bone, being more or less porous and harboring bacteria usually keeps up continuous suppuration. Such foreign bodies as communicate with the fistulous tracts or are large and accessible are removed. If small and encapsulated they are usually not molested.

Careful splinting or the application of a cast is essential where the bone has been much weakened. Operation with the limb in a Thomas splint is still advisable in certain cases months after the injury. Radical operation should never be attempted in the presence of an acute exacerbation.

The wound in the soft parts is usually left open and packed loosely with gauze. Partial closure may be made where the amount of infection is slight, but, as a rule, this is unsafe.

Wound healing occurs somewhat more rapidly and certainly with the use of the Carrel Dakin technic, which is the routine after treatment, but it is of minor importance in comparison with the operation, and healing occurs without a very striking difference when dry dressings are used.

The following cases are illustrative of some of the conditions with which one has to deal in fractures of various portions of the femur.

CASE I—Private A M, wounded August 10, 1918, by high explosive entering in the left sub- and supratrochanteric regions, fracturing the upper end of shaft of femur and perforating the ileum above the acetabulum. Wound debridement in thirty hours. Treated in Base Hospital with limb in Thomas splint for ten weeks, then in plaster-of-Paris cast for three months. Considerable discharge from both wounds, especially from upper. Patient was septic, lost weight, and ran a continuous temperature. Cast removed in January, when fracture was healed. Operation February 15th for removal of dead bone from femur. Continued to run temperature and have discharge until admitted to U S General Hospital No. 28 in April.

At that time he was emaciated and moderately septic. The

left thigh was markedly deformed about the hip and $2\frac{1}{2}$ inches shorter than the right. There was a fistula leading down to the subtrochanteric region of the femur and a larger one with much discharge in the supratrochanteric region. A probe could be passed inward along this backward tract through the iliac bone into the pelvis. Pelvic examination revealed a tender mass on

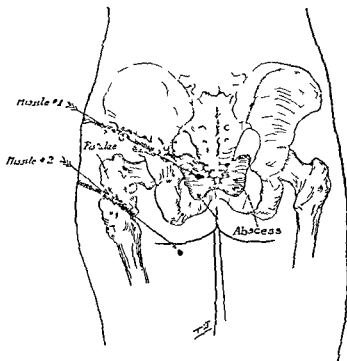


Fig. 274—Sketch from x ray showing fractures tunnels fistulae and foreign bodies, with abscess in pelvis draining incompletely through the upper fistula.

either side of the rectum above the levator ani. There was slight mobility in the hip joint.

x Ray examination showed a healed left subtrochanteric fracture with marked abduction of the upper fragment and irregular callus at the seat. No tunnel was seen in the x ray. Questionable sequestrum shadow was present on the internal sur-

[illegible]

Figure 1. Schematic representation of the experimental design. The subjects were divided into two groups: the control group and the experimental group. The control group received a standard diet, while the experimental group received a diet supplemented with 0.5% of the active ingredient. The subjects were then subjected to a 12-week period of physical training. The results of the study are presented in the form of a bar chart, showing the mean values and standard deviation for each group.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

1. *Journal of the American Medical Association*, 2000; 283: 2686-2692.

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Figure 6

Diagram illustrating the process of identifying and validating potential biomarkers for early detection of colorectal cancer. The process involves comparing gene expression profiles from normal colon tissue (left) and colorectal cancer tissue (right). Genes are ranked based on their differential expression, and those showing significant up-regulation in cancer tissue are identified as potential biomarkers. These genes are then validated through various methods, including qPCR and Western blot analysis, to confirm their expression levels in both normal and cancerous tissues.

Abstract

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Year	Number of cases	Number of deaths	Number of cases per 100,000 population	Number of deaths per 100,000 population
1990	1,000	100	10.0	1.0
1991	1,100	110	11.0	1.1
1992	1,200	120	12.0	1.2
1993	1,300	130	13.0	1.3
1994	1,400	140	14.0	1.4
1995	1,500	150	15.0	1.5
1996	1,600	160	16.0	1.6
1997	1,700	170	17.0	1.7
1998	1,800	180	18.0	1.8
1999	1,900	190	19.0	1.9
2000	2,000	200	20.0	2.0
2001	2,100	210	21.0	2.1
2002	2,200	220	22.0	2.2
2003	2,300	230	23.0	2.3
2004	2,400	240	24.0	2.4
2005	2,500	250	25.0	2.5
2006	2,600	260	26.0	2.6
2007	2,700	270	27.0	2.7
2008	2,800	280	28.0	2.8
2009	2,900	290	29.0	2.9
2010	3,000	300	30.0	3.0
2011	3,100	310	31.0	3.1
2012	3,200	320	32.0	3.2
2013	3,300	330	33.0	3.3
2014	3,400	340	34.0	3.4
2015	3,500	350	35.0	3.5
2016	3,600	360	36.0	3.6
2017	3,700	370	37.0	3.7
2018	3,800	380	38.0	3.8
2019	3,900	390	39.0	3.9
2020	4,000	400	40.0	4.0

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Project Name	Project Manager	Project Sponsor	Project Status	Project Start Date	Project End Date
Project A	John Doe	Jane Smith	Completed	2023-01-01	2023-03-31
Project B	Jane Smith	John Doe	In Progress	2023-04-01	2023-06-30
Project C	John Doe	Jane Smith	On Hold	2023-07-01	2023-09-30
Project D	Jane Smith	John Doe	Planned	2023-10-01	2023-12-31

Figure 1. Schematic representation of the experimental design. The subjects were divided into two groups: the control group (CG) and the experimental group (EG). The CG received a standard diet (SD) and the EG received a high-fat diet (HFD). The HFD was composed of 10% fat, 20% protein, and 70% carbohydrate. The subjects were divided into two groups: the control group (CG) and the experimental group (EG). The CG received a standard diet (SD) and the EG received a high-fat diet (HFD). The HFD was composed of 10% fat, 20% protein, and 70% carbohydrate. The subjects were divided into two groups: the control group (CG) and the experimental group (EG). The CG received a standard diet (SD) and the EG received a high-fat diet (HFD). The HFD was composed of 10% fat, 20% protein, and 70% carbohydrate.

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left thigh was markedly deformed about the hip and $2\frac{1}{2}$ inches shorter than the right. There was a fistula leading down to the subtrochanteric region of the femur and a larger one with much discharge in the supratrochanteric region. A probe could be passed inward along this backward tract through the iliac bone into the pelvis. Pelvic examination revealed a tender mass on

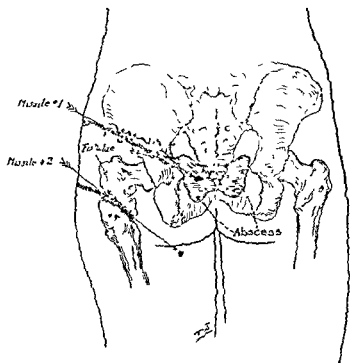


Fig. 274—Sketch from x-ray, showing fractures, tunnels, fistulae, and foreign bodies, with abscess in pelvis draining incompletely through the upper fistula.

either side of the rectum above the levator ani. There was slight mobility in the hip-joint.

x-Ray examination showed a healed left subtrochanteric fracture with marked abduction of the upper fragment and irregular callus at the seat. No tunnel was seen in the x-ray. Questionable sequestrum shadow was present on the internal sur-

marked contrast to the dead bone. This is because they are sterile on the inside and easily become encapsulated, while dead bone, being more or less porous and harboring bacteria usually keeps up continuous suppuration. Such foreign bodies as communicate with the fistulous tracts or are large and accessible are removed. If small and encapsulated they are usually not molested.

Careful splinting or the application of a cast is essential where the bone has been much weakened. Operation with the limb in a Thomas splint is still advisable in certain cases months after the injury. Radical operation should never be attempted in the presence of an acute exacerbation.

The wound in the soft parts is usually left open and packed loosely with gauze. Partial closure may be made where the amount of infection is slight, but, as a rule, this is unsafe.

Wound healing occurs somewhat more rapidly and certainly with the use of the Carrel Dakin technic, which is the routine after treatment, but it is of minor importance in comparison with the operation, and healing occurs without a very striking difference when dry dressings are used.

The following cases are illustrative of some of the conditions with which one has to deal in fractures of various portions of the femur.

CASE I—Private A M, wounded August 10, 1918, by high explosive entering in the left sub- and supratrochanteric regions, fracturing the upper end of shaft of femur and perforating the ileum above the acetabulum. Wound debridement in thirty hours. Treated in Base Hospital with limb in Thomas splint for ten weeks, then in plaster-of Paris cast for three months. Considerable discharge from both wounds, especially from upper. Patient was septic, lost weight, and ran a continuous temperature. Cast removed in January, when fracture was healed. Operation February 15th for removal of dead bone from femur. Continued to run temperature and have discharge until admitted to U S General Hospital No 28 in April.

At that time he was emaciated and moderately septic. The

Because of patient's poor condition the further radical operation necessary for the obliteration of the tunnels through the ilium and the femur was not performed.



Fig. 26—Ilium and femur one month after operation

Postoperative—The patient's general condition markedly improved and now at the end of six weeks the sinuses have closed both laterally and posteriorly (Fig. 276). However, he has run an afternoon fever of 1 to 1½ degrees most of the time which probably means that infection is still present in the course of the

face of thigh 3 inches lower down. There was a streak of lessened density extending obliquely downward through the ilium in the region of the fistula with surrounding new bone formation. The shadow of a foreign body appeared 2 cm internal to the ischial spine which on localization proved to be 7 cm from the rear. Figure 274 is a sketch from the x ray and also shows the pelvic abscess.

Operation (*April 18, 1919*)—Posterior perineal incision centering over ischial spine. Large horseshoe shaped abscess opened about rectum and between levator ani muscle and pelvic

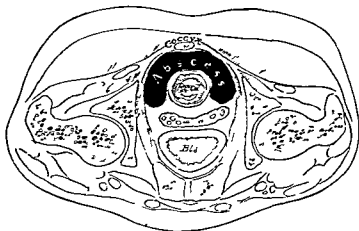


Fig. 275—Relation of abscess between levator ani and pelvic peritoneum to rectum.

peritoneum (Fig. 275). Foreign body found in abscess cavity and extracted. This abscess which was of months' standing and lined with a pyogenic membrane communicated with and drained imperfectly through the fistula penetrating the ilium and opening on to the supratrochanteric region.

Lateral incision was made, exposing seat of fracture in femur. Tunnel through callus from anteromesial to posterolateral portions discovered, large ledge chiseled off about opening of tunnel anteriorly and sequestrum removed from its posterolateral opening.

CASE II—Private J. A., injured by machine gun bullet September 27, 1918, sustaining a fracture in the subtrochanteric region. Debridement sixty hours after injury. The limb was kept in a Thomas splint for six and one half months until healing

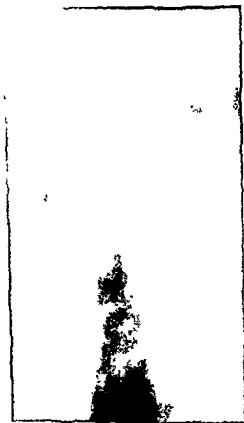


Fig. 278.—Condition of fracture shown in Fig. 277 one month after operation

was complete. The wound in the soft parts healed except for a sinus laterally, which continued to discharge profusely. Dakin's solution through an enlarged opening was used for two and a half months before admission, April 12, 1919, but did not modify the condition. x Ray (Fig. 277) side view taken April 15, 1919,

tunnels through the hum and femur, which may lead to re-establishment of the fistulæ and necessitate further operative interference for their obliteration. In the case of the femur the removal



Fig. 277—Side view of healed oblique fracture of upper end of femur with numerous sequestra

of the weaker anteromesial wall would be indicated in the hum extensive removal of the external wall leaving a crater shaped defect into which the gluteal muscles can sink.

sinuses to dead bone groove in callus and the upper foreign body. Posterior walls of groove and sinus in bone removed and dead bone extracted. Foreign body in fistula extracted through enlarged



Fig. 279—Fracture healed with sequestrum and foreign bodies in vicinity

anterior opening. All of the other foreign bodies were encapsulated and were not disturbed.

Wound healing has been rapid and in five and a half weeks

shows the type of fracture. There is a very oblique fracture line with shadows suggesting sequestra and lessened density, suggesting a tunnel running obliquely downward and backward across the bone.

Operation (April 16 1919)—Lateral incision exposing outer and anterior surfaces of seat of fracture. There are cloacæ anteromedially, laterally and posterolaterally, and a tunnel extending along the oblique fracture line connecting them. Sloping removal of the anterolateral wall of the tunnel which was found to contain seven sequestra of varying sizes. The soft parts could then fall in and fill out the defect. The remaining posterior bridge was sufficiently strong to support the limb.

Postoperatively, with Carrel Dakin treatment, the exposed wall of the tunnel and the remaining cut surfaces soon became covered over with granulations and at the end of seven weeks the wound is healed except superficially. Figure 278 shows x ray of the remaining bridge of bone.

CASE III—Private H. On July 30 1918 sustained comminuted fracture of left femur 4 inches below trochanter from high explosive shell. Debridement twenty four hours later. Treated with Thomas splint for five months when healing was complete but discharging sinus persisted. Operation February 1 1919 for removal of dead bone but sinus persisted.

Upon admission to General Hospital No. 28 April 12 1919 there was union with $1\frac{1}{2}$ inches of shortening and a discharging sinus on the anteromedial and the lateral sides of the thigh at the level of fracture. x Ray (Fig. 279) showed union with marked irregularity and evidence of dead bone at seat of fracture. Large foreign body in soft parts medial to fracture and several smaller fragments lower in muscles of thigh.

Operation (April 17 1919)—Lateral incision exposing seat of fracture. There is a deep groove with dead bone and overhanging ledge along posterior surface of callus and extending obliquely downward along fracture line. A probe leads on posterior surface of femur through sinus on mesial surface of thigh where foreign body can be felt. Figure 280 shows relation of

Examination showed $2\frac{1}{2}$ inches of shortening of right femur, and x ray examination (Fig. 281) showed imperfect union and position with three large pieces of dead bone at the seat of fracture, and two fragments of the machine gun bullet embedded in the soft parts anteriorly.



Fig. 281 —Sketch of x ray (side view) showing malunion, sequestra and foreign bodies six months after injury and preceding operation.

Operation (March 18, 1919) —With limb in Thomas splint the anterior opening was enlarged and a posterolateral longitudinal incision made down to bone. Three sequestra removed from the suppurating seat of fracture. Foreign bodies in soft

months and the limb recovered. If after several months the bridge of bone does not hypertrophy sufficiently to support the limb a heavy bone transplant from the tibia will be inlaid into either fragment making a reinforcing bridge for the gap.



Fig. 283.—Healed fracture of femur with large cavity opening from side.

CASE V.—Private E. P. received a high explosive fracture of the middle portion of the right femur July 18, 1918. Debride

parts were encapsulated and had no connection with the sinuses. The smaller one was located and extracted but the larger one could not be found. Wound packed and dressed with dry dressings. In six weeks both wounds were healed but the fracture



Fig. 281. Five weeks after operation. Wound healed after removal of sequestrum despite presence of large abscess in neighboring soft parts.

was not yet solid as shown by manipulation and another x-ray (Fig. 282). The patient was then placed on a Hawley table and a body and leg cast applied since which time he has been getting all out on crutches. The cast will be removed at the end of three

months and the limb is rayed. If after several months the bridge of bone does not hypertrophy sufficiently to support the limb, a heavy bone transplant from the tibia will be inlaid into either fragment, making a reinforcing bridge for the gap.

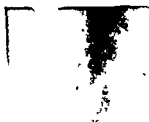


Fig. 283 —Healed fracture of femur with large cavity opening from side

CASE V —Private E. P. received a high explosive fracture of the middle portion of the right femur July 18, 1918. Debride-

ment July 20 1918. Treated in Thomas' splint for six months until fracture healed. Was operated on three and seven and a half months after injury for dead bone.

On admission to U. S. General Hospital No. 28 April 1 1919 there was a large discharging wound on anteromedial surface of



FIG. 4.—After enlargement of enough of cavity wall to allow soft part to fall in. Compare FIG. 3.

thigh about seat of fracture. X-ray examination (Fig. 3d) showed a healed fracture of the femur with spindle-shaped callus along lateral side and in side view a large opening could be

seen in the mesial side of the bridge. A piece of high explosive shell was present on the posterior side of the lower end of the upper fragment. After the wound leading down to bone had improved and a small sequestrum had been extruded the bone was operated on May 10th for the obliteration of the pocket. The anteromesial wound was enlarged and bone freed at seat of fracture. There was a large hole in the medullary region lined with healthy granulation tissue. Its walls were extensively removed especially below and posteriorly so that the soft parts could fall in and fill out the cavity. There was no fistula leading to the foreign body which was left. Figure 284 shows the condition ten days later.

At the present time three weeks after operation the bony surface is almost completely covered with granulations and there is little discharge from the wound. The extent of removal of bone from the mesial side is not apparent in the x ray because of the overlapping of the shadow of the anterior cortex.

CASE VI—Private J received a machine gun bullet fracture of left femur 4 inches above the knee on July 18 1918. Wound debrided July 20th. Afterward treated in Thomas splint until union completed three and a half months later. Posterolateral sinus continued to discharge up to admission to U. S. General Hospital No. 28 April 18 1919. No operation had been performed for the removal of dead bone.

x Ray examination (Fig. 285) showed oblique healed fracture with moderate posterior angulation and lateral displacement of lower fragment. Heavy shadows of pieces of dead bone can be seen extending obliquely along fracture line the largest one being at the lower end. The side view (Fig. 286) fails to reveal the dead bone distinctly.

Operation (April 24 1919)—Posterolateral incision down to bone showed many dead fragments at lower end of break and a tunnel extending obliquely upward and inward along fracture line. A second mesial incision was made and a cortical opening with dead bone found at upper end of the fracture line. In order to obliterate the tunnel the soft parts were then separated

ment July 20 1918 Treated in Thomas splint for six months until fracture healed Was operated on three and seven and a half months after injury for dead bone

On admission to U S General Hospital No 28 April 1 1919 there was a large discharging wound on anteromedial surface of

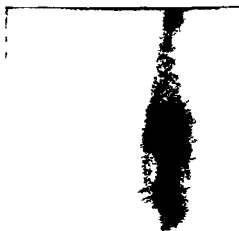


Fig. 284 After effacement of enough of callus wall so a low soft part to fall in compare Fig. 283

thigh about seat of fracture x Ray examination (Fig. 283) showed a healed fracture of the femur with spindle-shaped callus along lateral side and in side view a large opening could be

wounds were healed at the end of five and a half weeks and the patient is now (June 1st) getting around on crutches. No more striking effect of the removal of dead bone and one wall of a

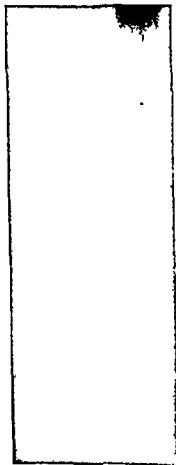


Fig. 286—Side view of femur (compare Fig. 285)

tunnel has been seen than this. Had Dakin's solution been used some would have attributed the rapidity of healing to its action.

from the bone anterolaterally and a sloping spiral removal of the anterolateral bridge performed. Several more pieces of dead

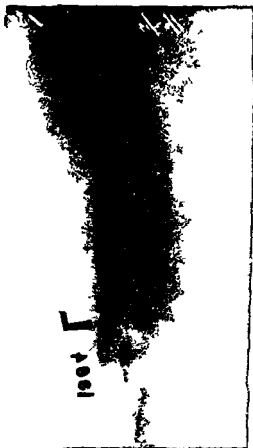


Fig. 285.—Healed oblique fracture of femur with tunnel and sequestra

bone were then removed from the middle portion of the tunnel. Figure 287 shows the remaining bridge four weeks after operation.

Daily dry dressings were used in the after treatment. The

removal of dead bone, although there had been a continuous profuse discharge from the wound of exit.

Examination showed fracture united by large callus. Dakin tube was inserted in lateral opening.



Fig. 288.—Healed fracture of femur with dead bone and tunnel.

The Ray (Fig. 288) showed cavity with dead bone in femur 3 inches above joint with mesial and lateral openings in the newly formed bony ridge.

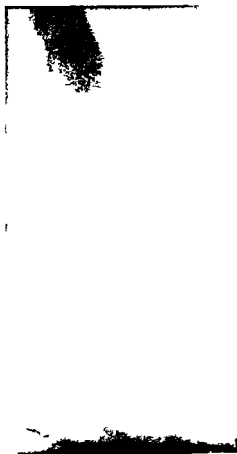


Fig. 28 After removal of anterolateral wall of tunnel and dead bone

CASE VII—Private E wounded September 18 1918 by machine gun bullet entering mesial side and passing out on lateral side of thigh 3 inches above knee producing a compound comminuted fracture of femur. Wound opened and drained three days later. Thomas splint applied and worn until admitted to hospital March 5 1919. No operation had been performed for

removal of dead bone, although there had been a continuous profuse discharge from the wound of exit

Examination showed fracture united by large callus Dakin tube was inserted in lateral opening



Fig 288—Healed fracture of femur with dead bone and tunnel

x Ray (Fig 288) showed cavity with dead bone in femur 3 inches above joint with mesial and lateral openings in the newly formed bony ridge



Fig 28 — After removal of anterolateral wall of tunnel and dead bone

CASE VII—Private E wounded September 18 1918 by machine gun bullet entering mesial side and passing out on lateral side of thigh 3 inches above knee producing a compound comminuted fracture of femur Wound opened and drained three days later Thomas splint applied and worn until admitted to hospital, March 5 1919 No operation had been performed for

removal of dead bone, although there had been a continuous profuse discharge from the wound of exit

Examination showed fracture united by large callus. Dikin tube was inserted in lateral opening



Fig 288—Healed fracture of femur

x Ray (Fig 288) showed cavity 2 inches above joint with mesial and lateral bony ridge

Operation (*March 18, 1919*)—Long lateral and short mesal incisions down to sinuses. A large lateral window was found in cortex with a cleft running upward along an oblique fracture line



F g 289—After removal of dead bone (compare F g 288)

Opening enlarged and several large pieces of dead bone removed from the cavity. Mesial opening slightly enlarged. This left a tunnel transversely through the bone but neither the anterior

nor the posterior wall appeared sufficiently strong to support the extremity at the time, so both were left and the wound treated postoperatively with Dakin's solution, while the infection cleared up and the bony bridges became stronger. A large portion of the lateral wall of the posterior bridge underwent necrosis from denudation of soft parts and separated in four and a half weeks as a

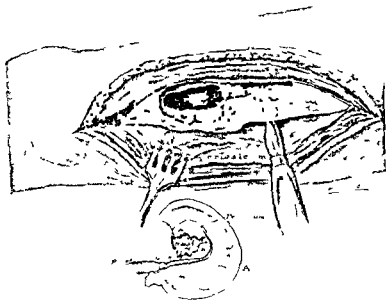


Fig. 290—Incision and separation of periosteum and soft parts from posterior bridge to be removed. A shows in section how curved periosteotome elevates periosteum from bone.

sequestrum when it was extracted. The entire bony surface then became covered with healthy granulations and discharged very little. Figure 289 shows the tunnel May 3, 1919. The anterior bridge then appeared sufficiently strong to support the limb. Consequently the posterior bridge was removed May 10th through a slightly curved lateral incision, cutting the soft parts and periosteum along the line of incision in the bone (Fig. 290).

Operation (*March 18, 1919*) —Long lateral and short mesial incisions down to sinuses. A large lateral window was found in cortex with a cleft running upward along an oblique fracture line

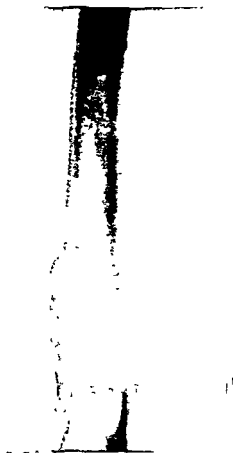


Fig. 289 —After removal of dead bone (compare Fig. 288)

Opening enlarged and several large pieces of dead bone removed from the cavity. Mesial opening slightly enlarged. This left a tunnel transversely through the bone, but neither the anterior

nor the posterior wall appeared sufficiently strong to support the extremity at the time, so both were left and the wound treated postoperatively with Dakin's solution while the infection cleared up and the bony bridges became stronger. A large portion of the lateral wall of the posterior bridge underwent necrosis from denudation of soft parts and separated in four and a half weeks as a

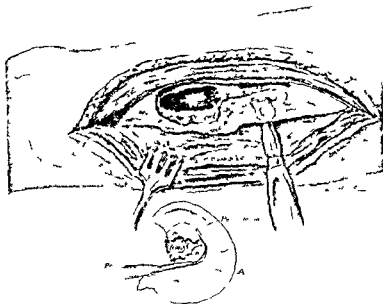


Fig. 290 —Incision and separation of periosteum and soft parts from posterior bridge to be removed. A shows in section how curved periosteotome elevates periosteum from bone.

sequestrum when it was extracted. The entire bony surface then became covered with healthy granulations and discharged very little. Figure 289 shows the tunnel May 3, 1919. The anterior bridge then appeared sufficiently strong to support the limb. Consequently the posterior bridge was removed May 10th through a slightly curved lateral incision cutting the soft parts and periosteum along the line of incision in the bone (Fig. 290).

The soft parts were then separated from the bridge around the mesial window with a large curved sharp peno teotome especially constructed for femur work. The bridge was then removed



Fig. 791—After removal of posterior wall of tunnel. Compare Figs. 288 and 290.

by a sloping incision at either end which extends through the lateral cortex across the medullary canal and through the opposing mesial cortex. This left the condition shown in Fig

291 The bone incision at the lower end should have sloped more, as it would have permitted the hamstring muscles to fall in more

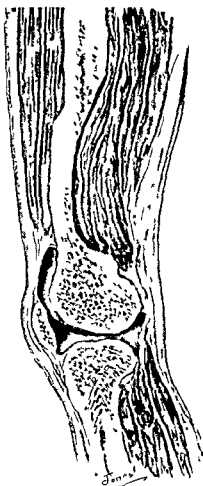


Fig. 292 —Condition to be attained when healing is completed

easily. The clear spot in the x ray taken May 29, 1919, shows that this has not yet occurred but the infection has about disappeared and granulations will no doubt pull the soft parts into the

defect in the course of a few weeks as shown schematically in Fig 292 The anterior bridge is sufficiently strong to support the limb without the aid of a splint but it will be months before it has increased in size to a point that will permit of full weight bearing

CASE VIII—Private G on May 15 1918 received a high explosive fracture of right femur $3\frac{1}{2}$ inches above knee Wound debridement in fifteen hours Body and leg cast applied and wounds dressed through lateral opening Two months later under ether the fragments were manipulated in an attempt to overcome the shortening and angulation Plaster cast reapplied Following this wound was opened several times for the establishment of drainage In September plaster cast was replaced by Thomas splint which he has worn since Operation in December for removal of dead bone Deformity and sinus have persisted

Examination on admission to U S General Hospital No 28 April 24 1919 showed 3 inches of shortening with upper fragment overriding lower on its outer border Mobility still present at line of junction Knee markedly stiffened Posterolateral sinus leading down to bone x Ray examination (Fig 293 1) shows the marked overriding and angulation of oblique fracture with incompletely ossified callus and a cavity containing a sequestrum in the lower fragment bordering on the overlapping upper end

Operation (May 1 1919)—Through a posterolateral incision the sequestrum and granulations were removed from the cavity and the callus excised from along its margins

The after treatment was with Dakin's solution and in three weeks the wound was largely closed and covered with healthy granulations (Fig 293 2) It was decided to operate again with the idea of reducing the shortening and lateral displacement

the fragments were freed of

Hawley table and the Schroeder clamp the lower fragment was

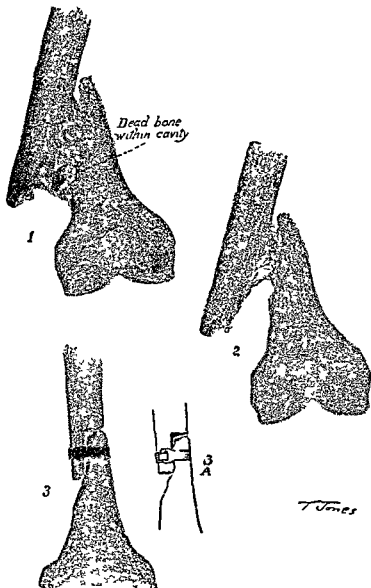


Fig 293 —1 Cavity and dead bone with non union eleven and a half months after injury 2 Condition after removal of sequestrum and injection with Dakin's solution 3 and 3A Fractures reduced and held by Parham band

brought down and fitted into the mortise of the upper, as shown in Fig 293, 3 and 3 A The fragments were fastened in position by a Parham band and a plaster-of Paris body and leg cast applied A window was cut out and the wound treated with Dakin's solution There has been little reaction since the operation, and it is hoped that bony union will occur in the presence of the moderate infection which is present As soon as sufficient callus has formed, which should require from three to four months the Parham band will be removed If dead bone should form as a result of the operation, it will subsequently be removed

It would have been better to wait until weeks after the wound was entirely healed before reducing the deformity, but with the large cavity in the upper end and bordering on the lower end of the upper fragment, healing would not take place without removal of the overlapping upper fragment, in which case reduction would then have been impossible The case illustrates how it may be necessary to take the chance of operating in the presence of infection reduced to a minimum in order to overcome extensive deformity

CLINIC OF MAJOR EDWIN W RYERSON

U S A GENERAL HOSPITAL No 28, FORT SHERIDAN, ILLINOIS
(ORTHOPEDIC SERVICE)

CHRONIC DISLOCATION OF OUTER END OF CLAVICLE: RECONSTRUCTION OF ACROMIOCLAVICULAR ARTICU- LATION BY THE AID OF A STRIP OF FASCIA LATA

Summary Inability to abduct arm from side without pain as a result of accidental injury sustained three years previously diagnosis operative findings method of suturing transplanted fascial strip, result

F R K, private, U S Army, while in service on the Mexican Border in July, 1916, was thrown from a bicycle, striking his left shoulder against the sidewalk. There followed considerable local pain and swelling, but no abrasion or flesh wound. The surgeon at Camp Wilson painted the shoulder with iodine and prescribed a liniment. The pain and disability gradually disappeared except when the patient attempted to abduct the arm from the side. He was only able to abduct to about 60 degrees. He was mustered out from border service January 20, 1917, but was recalled to service on April 4, 1917, and sent overseas on February 18, 1918. He continued to have pain on abduction of shoulder, and an x ray examination was made at Limoges, France, Base Hospital No 13, which did not disclose a fracture. He was given orderly duty in France because carrying a pack caused pain in the shoulder. He was gassed and sent to a hospital, where he recovered entirely from effects of gas, but was kept in hospital on account of trouble in the shoulder.

He was transferred to the United States, and sent to General Hospital No 28 Fort Sheridan, Illinois, Orthopedic Service, a short time ago.

On admission to this hospital examination revealed an upward dislocation of the left clavicle at the acromioclavicular joint, the

brought down and fitted into the mortise of the upper as shown in Fig. 293, 3 and 3A. The fragments were fastened in position by a Parham band and a plaster-of-Paris body and leg cast applied. A window was cut out and the wound treated with Dakin's solution. There has been little reaction since the operation and it is hoped that bony union will occur in the presence of the moderate infection which is present. As soon as sufficient callus has formed which should require from three to four months the Parham band will be removed. If dead bone should form as a result of the operation it will subsequently be removed.

It would have been better to wait until weeks after the wound was entirely healed before reducing the deformity, but with the large cavity in the upper end and bordering on the lower end of the upper fragment, healing would not take place without removal of the overlapping upper fragment, in which case reduction would then have been impossible. The case illustrates how it may be necessary to take the chance of operating in the presence of infection reduced to a minimum in order to overcome extensive deformity.

displacement being about $\frac{1}{2}$ inch. The clavicle could readily be replaced, but immediately returned to its abnormal position. There was no tenderness or pain except when abducted beyond 60 degrees. The deltoid was somewhat smaller than on the right side and the muscular power was much diminished. There was no grating or crepitus on motion.

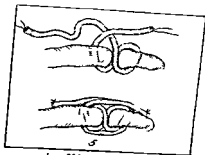
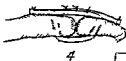
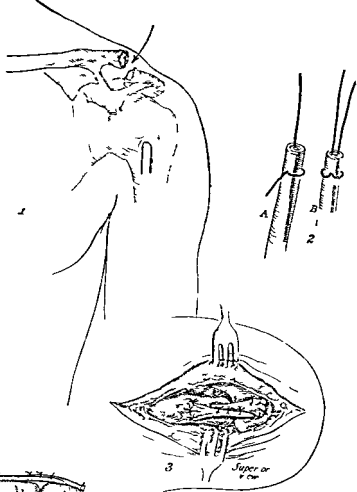
The x ray plates showed no bone disease and no fracture. The distance between the acromion and the clavicle was increased.

In view of the very considerable disability an operation was performed by the following method.

The acromion and the outer third of the clavicle were exposed. The acromioclavicular ligament was found to have been torn completely from its acromial attachment, and to have been partially repaired by cicatricial tissue. It was so long and lax that it exercised no restraint whatever upon the abnormal mobility of the joint. The coracoclavicular ligament was untorn, but was apparently of unusual length so that it did not prevent the undue upward movement of the clavicle (Fig 294, 1).

A hole was drilled with a $\frac{3}{16}$ -inch drill downward and outward through the end of the clavicle, toward the bottom of the articulation. A similar hole was then drilled downward and inward through the acromion, converging toward the bottom of the clavicular hole. A strip of fascia lata 4 inches long and 1 inch wide was cut from the thigh and was carefully denuded of fat. It was then rolled up to form a cord, and a strong suture was sewed into one end to be used in pulling the fascial cord through the holes in the bones. The suture is a combination of purse-string and mattress suture and is very useful in this sort of work, as it prevents the ends from stripping back and also gives a firm hold on the fascia or tendon (Fig 294, 2).

Fig 294—1 Schematic representation of operative findings. Note complete tear of acromioclavicular ligament and apparent lengthening of coracoclavicular ligament thus permitting upward dislocation of outer end of clavicle. 2 *A* and *B* Method of inserting sutures in artificial ligament of fascia lata. 3 Fascial transplant sutured in position operation will be completed by closure of skin incision. 4 Diagram of way in which roll of fascia was used. 5 Proposed improved method.



The fascial cord was now passed through the holes and pulled tightly enough to approximate the acromion and clavicle. The ends of the cord were lapped over each other and sutured firmly together and to the periosteum of the bones with chromicized catgut (Fig 294, 3-4). The line of union seemed very strong, and there was no tendency to displacement when the arm was moved up and down.

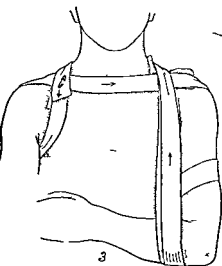
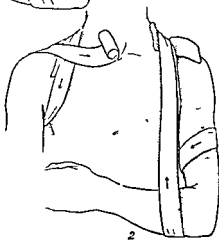
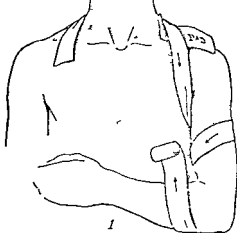
The skin was sutured and the wound dressed. A figure of eight bandage was applied, going under the elbow and over the shoulder, crossing the clavicle, and down on the other side below the right axilla, so as to hold the arm up and the clavicle down. A felt pad was placed under the bandage where it crossed the clavicle and the wound (Fig 295, 1-3).

Comment—The patient made an uninterrupted recovery, and after eight weeks was able to abduct his arm to practically the full normal extent without pain. He is now apparently entirely well.

It was at first believed that it would be necessary to perform a similar procedure with the coracoclavicular ligament, as it seemed likely that this structure had been torn, or at least overstretched, since it presumably has more part in checking the upward movement of the clavicle than has the acromioclavicular ligament. The outcome of the case, however, shows that it was not necessary.

The technic of the operation could have been improved by passing the fascial cord in figure of eight fashion from the clavicle to the acromion, as it would form a sort of crucial ligament instead of a loop, and the upward motion of the clavicle would be better controlled (Fig 294, 5).

Fig 295—1-3, Method of applying postoperative dressings. Their object is to support the arm and help to overcome tendency of clavicle to be displaced upward.



Tex Jones

FLAIL ELBOW FOLLOWING EXCISION OF LOWER END OF HUMERUS. OPERATION TO PRODUCE STABILITY OF ELBOW-JOINT

Summary Complete destruction of elbow joint due to lodgment of fragment of high explosive shell and subsequent debridement resulting in flail elbow condition eight months later preparation for operation, use of antitetanic serum, technic of reconstruction of joint result

A K, private, A E F On August 4, 1918, in the Argonne Forest the patient was struck by a fragment of high explosive shell in the right elbow. A compound comminuted fracture of the lower third of the humerus and the upper end of the radius resulted, the missile entering above the external condyle, passing downward, and embedding itself just below the head of the radius. The wound was dressed at a first aid station, and antitetanic serum administered about a half hour after the injury was received. He was sent to the hospital at Chateau-Thierry the next day, and was operated upon at 9 P M the same night, August 5th. A debridement was performed, and the lower end of the humerus and the upper end of the radius were removed. A Thomas arm splint was applied and two days later the patient was sent to Base Hospital No 5 at Paris. The Carrel Dakin treatment was instituted, and twenty days later a pocket of pus was evacuated at the upper end of the wound. The Dakin fluid was used until October 2d, when the wounds were dressed with dry gauze and a plaster splint applied. The wound was completely closed on December 18th. Evacuation to Ellis Island Hospital November 18th, and sent to Fort Sheridan on March 2, 1919.

On removal of the cast the elbow was found to be a typical flail joint, bending backward and sideways as readily as it bent forward. It could also be twisted around freely on the long axis. The patient had no control of the joint, and was unable to move the forearm upon the arm except by shaking it around in a dangling fashion. The wound was healed, and the scar was pale and painless. The muscles above and below the joint were atrophied,

and the fingers and wrist were stiff from disuse. The lower end of the humerus was narrow and pointed, and the condyles were absent. The head of the radius could not be felt.

x Ray examination confirmed the physical findings, and did not disclose any sequestra or foreign bodies. All of the bones showed marked atrophy of disuse.

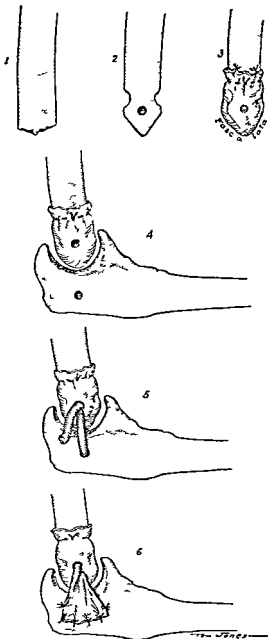
For two weeks the arm was used as freely as possible, and was massaged in order to bring to light any latent infection which might be present. There was no reaction whatever to these vigorous measures, and it was considered safe to perform an operation to restore some measure of stability to the loose joint. Antitetanic serum was administered, and on March 18th he was anesthetized after twenty-four hours' preparation of the field of operation.

The long scar on the lateral aspect of the arm and forearm was carefully dissected away, and the joint was exposed. The lower end of the humerus was brought into view, and was simply a narrow cylinder of bone with a pointed end. It had been shortened about $2\frac{1}{2}$ inches by the removal of the condyles and the expanded lower part of the shaft. In accordance with a pre-conceived plan (original so far as the writer knows), the lower end of this bone was sawed into a wedge shape with a small hand saw, and a piece of fascia lata was securely sewed over the end and about $1\frac{1}{2}$ inches upward on the shaft, covering all of the exposed bone. This latter procedure was perhaps unnecessary, but was deemed advisable in order to prevent a possible bony ankylosis (Fig. 296, 1, 2, 3).

The upper end of the ulna was now freed from adhesions and brought out of the incision. The greater sigmoid fossa was cleaned of the dense scar tissue which filled it, and was made larger and longer by filing it out with a round file. The end of the humerus was now placed in the sigmoid fossa and was found to fit it rather accurately from side to side, and to allow a very

FIG. 296.—1, 2, 3. Preparation of bone and joint.

• 10 inches
• bone
• lateral



NEUROMA OF MEDIAN NERVE IN PALM OF HAND DUE TO GUNSHOT WOUND

Summary Healed gunshot wound of hand with evidence of involvement of flexor tendons and median nerve large neuroma discovered at operation excision of neuroma and end to end suture with hand in flexion

SERGEANT R E M , 128th Infantry, was struck at the base of the hand by a machine gun bullet in the Argonne Forest on November 10, 1918 Four hours later a first aid dressing was applied and he was given antitetanic serum Bandages were changed at Field Hospital No 128, and an operation was performed the next day at Evacuation Hospital No 6, under ether He then passed through several base hospitals and was sent to Newport News Dakin's solution was used for six weeks after the operation, and the wound healed on December 18, 1918

He was admitted to U S General Hospital No 28, Fort Sheridan, Illinois, on March 24 1919

Examination showed a scar 8 cm in length running transversely over the thenar eminence in the palm of the hand This marked the exit of the bullet The wound of entrance was indicated by a small scar 2 cm below the styloid process of the ulna on the posterior part of the wrist joint

Dorsal flexion of the wrist was slightly limited, and palmar flexion was normal He was unable to close the fingers completely or to extend them actively to the full range of motion Passive extension was normal Tactile sensation was markedly diminished over the distribution of the median nerve and slightly diminished over ulnar side of palm and last two fingers The palm and first three fingers were glossy and sweating and the nails showed trophic changes The thenar eminence was atrophied

On movement of the fingers the flexor tendons could be seen to pull on the scar which limited motion considerably

x Ray examination showed fracture of unciform bone (os hamatum) with wide separation of fragments The pisiform bone was absent

fair range of flexion and extension (Fig 296, 4) In order to increase this range of motion notches were cut in the humerus front and back, to allow the olecranon and the coronoid process to sink into them at the extremes of motion A $\frac{1}{4}$ -inch hole was now drilled transversely through the humerus, and a similar hole through the ulna midway between olecranon and coronoid and a long piece of fascia lata, rolled up into a cord, was passed through these holes so as to approximate the two bones and to hold the humerus in place in the sigmoid fossa The fascial cord was sewed firmly to itself and the ends were spread out like a fan and sewed to the ulna, to imitate the lateral ligaments (Fig 296 5, 6)

This made a firm and satisfactory joint with a good range of motion, and very little tendency to lateral deviation, so far as could be judged at the time The incision was sutured and a plaster-of Paris splint applied and split up both sides so as to make an anterior and a posterior molded splint This was to have been supported by a sling to prevent strain upon the fascial ligament, but through an error the sling was not used until several days after the operation, so that the fascial cord actually carried the weight of the forearm and the cast for a considerable length of time

It speaks well for the method that the result has been satisfactory The wound healed rapidly and in about six weeks active movements were begun The joint is now stable, and the patient is rapidly gaining strength He can move the elbow through an arc of about 65 degrees and the joint is painless It is not yet possible to state an opinion as to the ultimate result, and a further report will be made at a later date

NEUROMA OF MEDIAN NERVE IN PALM OF HAND DUE TO GUNSHOT WOUND

Summary Healed gunshot wound of hand with evidence of involvement of flexor tendons and median nerve large neuroma discovered at operation, excision of neuroma and end to end suture with hand in flexion

SERGEANT R. E. M., 128th Infantry, was struck at the base of the hand by a machine gun bullet in the Argonne Forest on November 10, 1918. Four hours later a first aid dressing was applied and he was given antitetanic serum. Bandages were changed at Field Hospital No. 128, and an operation was performed the next day at Evacuation Hospital No. 6, under ether. He then passed through several base hospitals, and was sent to Newport News. Dakin's solution was used for six weeks after the operation, and the wound healed on December 18, 1918.

He was admitted to U. S. General Hospital No. 28, Fort Sheridan, Illinois, on March 24, 1919.

Examination showed a scar 8 cm. in length running transversely over the thenar eminence in the palm of the hand. This marked the exit of the bullet. The wound of entrance was indicated by a small scar 2 cm. below the styloid process of the ulna on the posterior part of the wrist joint.

Dorsal flexion of the wrist was slightly limited, and palmar flexion was normal. He was unable to close the fingers completely or to extend them actively to the full range of motion. Passive extension was normal. Tactile sensation was markedly diminished over the distribution of the median nerve, and slightly diminished over ulnar side of palm and last two fingers. The palm and first three fingers were glossy and sweating, and the nails showed trophic changes. The thenar eminence was atrophied.

On movement of the fingers the flexor tendons could be seen to pull on the scar which limited motion considerably.

* Ray examination showed fracture of unciform bone (os hamatum), with wide separation of fragments. The pisiform bone was absent.

Operation was performed on May 17, 1919, under ether anesthesia. The transverse scar was excised (Fig 297, 1) and a careful dissection of the palmar structures was made, after cutting through the volar ligament. Directly under this ligament was a large bulb, easily identified as a neuroma of the median nerve, but of such great size that at first it was hardly recognized (Fig 297, 2). About 2 mm distal to the neuroma the nerve divided into three branches. With a small, keen knife the nerve trunk was cut through at both extremities of the neuroma and the two ends examined carefully. Normal nerve-bundles were seen projecting from the ends and neither scar tissue nor edema was observed. The tendons of the flexor sublimis and flexor profundus digitorum were found to be adherent to each other and to the walls of the canal and to the scar by a mass of thin delicate adhesions which were easily separated. It was not deemed advisable to try to make sheaths for these tendons since such work is not likely to be successful in this particular locality. It was decided to trust to passive and active motions of the fingers to preserve the mobility of the tendons.

The two ends of the nerve were now pulled upon gently to determine how nearly they would come together. It was found that they could easily be approximated when the wrist was held in about 60 degrees of flexion. A fine 00 chromicized catgut suture was now passed directly through the nerve about 3 cm from the end with a very small needle. It was then carried down and passed upward through the distal end of the nerve care being taken to see that the two nerve ends were in proper relation to each other in regard to rotation. With the hand held in flexion, the suture was tightened until the nerve ends were accurately approximated without tension. Four plain catgut sutures were now placed at intervals in the nerve sheath so as to close the gaps between the ends. This resulted in very satisfactory approximation (Fig 297, 3). The nerve was laid back into its bed without any attempt to make an artificial covering for it. The strong volar ligament was then united with interrupted catgut sutures, and the wound was closed with waxed silk.

The incision has healed without infection and the fingers

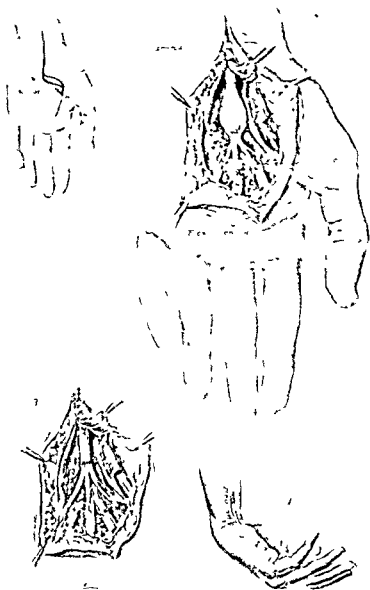


Fig. 297—1 Incision for removal of scar and exposure of tenodesis. 2 Large neuroma on median nerve an unexpected finding note lines of incision for its removal. 3 Nerve sutured after excision of neuroma. 4 Reversed cock up position of hand to prevent tension on suture line.

are freely movable through the range permitted by the amount of flexion of the wrist, which is still held in a reverse cock up splint. The splint will be retained for a four week period and the wrist will then be gradually straightened (Fig. 297, 4).

The case is of interest simply from the unusual size of the neuroma and from the fact that the tendon involvement seemed at first to be the major lesion.

CLINIC OF MAJOR LEWIS J POLLOCK

GENERAL HOSPITAL No 28, FORT SHERIDAN, ILLINOIS

PERIPHERAL NERVE INJURIES WITH ESPECIAL REFERENCE TO LESIONS OF THE BRACHIAL PLEXUS

Summary Frequency of peripheral nerve injury in modern warfare brachial plexus injuries types in civil and military life demonstration and diagnosis of typical cases coincidence of spinal cord and brachial plexus injury prognosis necessity of careful observations in order to avoid overrating speed of recovery antagonistic muscles in certain instances may become antagonistic apparent sensory recovery may be produced vicariously through anastomatic branches of neighboring nerves

PERIPHERAL nerve lesions have contributed the largest amount of neurologic material that has been dealt with in this war Statistics relative to the occurrence of peripheral nerve lesions sustained in battle are not as yet available Those obtained from the reports of the A E F are not reliable, for reasons which will be mentioned shortly The ordinary procedure by which the neurologist was afforded the opportunity to study these lesions was to have them referred to him by some other service That this method left much to be desired is now evident From the reports of the various consultants of base hospitals the figures in the chief consultant's office at one time gave the percentage of peripheral nerve lesions as 1.76 of total casualties

Inasmuch as this did not approach the figures given by the French and British, namely, between 5 and 6 per cent, a bed to

hospitals under my observation of a total of 2151 cases examined, who had wounds of the extremities, 322 cases of peripheral nerve lesions were found giving a percentage of 14.9 of cases examined, and of 4.5 of total population, which was 7049 It is evident that

are freely movable through the range permitted by the amount of flexion of the wrist, which is still held in a reverse cock up splint. The splint will be retained for a four week period and the wrist will then be gradually straightened (Fig 297, 4)

The case is of interest simply from the unusual size of the neuroma and from the fact that the tendon involvement seemed at first to be the major lesion

Direct lesions of the brachial plexus due to war wounds present no clearly defined classification. Ordinarily immediately following injuries there is complete paralysis of the brachial plexus which as the effects of the concussions disappear resolves itself into one or another type of involvement of one or more cords or an incomplete type of total brachial plexus paralysis.

Lesions of the inner cord of the brachial plexus are evidenced by paralysis of all the intrinsic muscles of the hand and some or all of the flexors of the wrist and fingers. Lesions of the posterior cord are evidenced by paralysis of the muscles supplied by the circumflex musculospiral and subscapular nerves. Lesions of the outer cord result in paralysis of the muscles supplied by the musculocutaneous and median nerve with the exception of the intrinsic muscles of the hand.

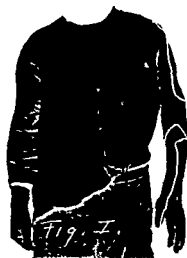


Fig. 298. Shaded areas indicate areas of sensory changes following lesions involving nerves from the fifth, sixth and seventh cervical segments.

CASE I—G. B. wounded July 15, 1918, by shrapnel with entrance just to the left of the midline of neck over the clavicle.

the percentage of cases of injuries to the peripheral nerves reported from the hospitals in the American Expeditionary Forces is dependent upon a number of factors and upon the same factors governing the observation of the number of cases occurring is the analysis of the types of cases observed. For example ulnar lesions were frequently reported, whereas median, especially incomplete medians, were often overlooked. Pre-eminently, lesions of the internal popliteal nerve were overlooked.

It is probable that if a careful survey were made peripheral nerve lesions would be found in 16 per cent. of all wounds of the extremities and in over 5 per cent. of total admissions.

Brachial plexus lesions have been said to constitute a greater percentage of incidents than all others by some English writers among whom may be mentioned Purves Stewart, who found 61 cases in a material consisting of 318 cases of peripheral nerve lesions. From a material consisting of 500 cases of peripheral nerve lesions observed soon after injury in base hospitals in France there was a total of 44 cases of brachial plexus lesions which were referred to me for examination.

That the number of cases of brachial plexus lesions reported by many observers does not bear a true relation to the total number of peripheral nerve cases is as evident as the fact that the correct percentage of peripheral nerve lesions is as yet unavailable. From the material at Fort Sheridan consisting of 250 cases, but 15 cases of brachial plexus lesions may be gathered. Thus it may be said is a small percentage.

The cases which I have for demonstration today have been selected for the purpose of demonstrating some of the types of brachial plexus lesions.

Brachial plexus lesions in civil practice have been divided as to type into lesions of the primary cords, secondary cords and root lesions. The secondary cords usually spoken of as the cords of the brachial plexus had been the most frequent type of lesions observed. The cases have likewise been divided into upper arm paralysis, as the Erb-Duchenne type of injury of the fifth and sixth cervical nerve and of the lower arm paralysis or the Klumpke type.

Direct lesions of the brachial plexus due to war wounds present no clearly defined classification. Ordinarily immediately following injuries there is complete paralysis of the brachial plexus, which, as the effects of the concussions disappear, resolves itself into one or another type of involvement of one or more cords or an incomplete type of total brachial plexus paralysis.

Lesions of the inner cord of the brachial plexus are evidenced by paralysis of all the intrinsic muscles of the hand and some or all of the flexors of the wrist and fingers. Lesions of the posterior cord are evidenced by paralysis of the muscles supplied by the circumflex musculospiral and subscapular nerves. Lesions of the outer cord result in paralysis of the muscles supplied by the musculocutaneous and median nerve with the exception of the intrinsic muscles of the hand.

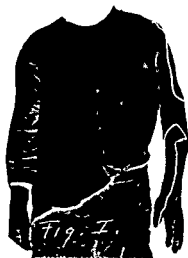


Fig. 298.—Shaded areas indicate areas of sensory changes following lesion involving nerves from the fifth, sixth, and seventh cervical segments.

CASE I—G. B. wounded July 15, 1918, by shrapnel with entrance just to the left of the midline of neck over the clavicle.

and exit over the spine of the scapula. He sustained a fracture of the left acromion process of the scapula. Upon examination he shows paralysis of the deltoid biceps very marked weakness in the supinators and in the muscles supplied by the subscapular nerves. There is analgesia anesthesia and loss of temperature sense over the fifth sixth and seventh cervical segments.

This case would be classified as an upper muscle type or an Erb's palsy. It could likewise be termed a combined partial posterior and outer cord lesion of the brachial plexus. The probability is that in this case the soldier sustained a lesion of the primary cord of the brachial plexus (Fig. 298).

CASE II—C. S. wounded October 5, 1918. Machine gun bullet entered shoulder just above scapula and lodged in neck above clavicle. The entire right arm completely paralyzed immediately following injury. In one month began to move fingers and at the same time sensation began to return. He then showed complete paralysis of the infra pinatus supra pinatus deltoid biceps trapezius triceps partially paralyzed upinator very weak extension and flexion of wrist moderately weak grip fair. At the present time he has motion in every muscle of the upper extremity and only weakness where paralysis formerly existed.

In this case we are dealing with a lesion of the posterior cord combined with the outer cord. Regeneration has occurred to such a degree that sensory disturbances are present only over the radial distribution.

CASE III—L. P. wounded October 18, 1918. Verdun gun shot wound of right shoulder entrance in a line below the clavicle and inside the shoulder joint exit 7 inches to the right of the spine over the eighth dorsal vertebra. Arm hangs helplessly by the side the hand is cold and moist. There is marked atrophy of the upper arm and deltoid the muscles of the forearm and palmar interossei. There are sensory disturbances over the distribution of the musculocutaneous internal cutaneous median and radial. At the present time it is noted that the deltoid is

slightly weak triceps weak, biceps very weak, supinators pull 1 pound, pronators 3, extensor carpi radialis 5, ulnaris paralyzed flexor carpi ulnaris pulls 12 radialis paralyzed, common extensors paralyzed, weakness of the two inner slips of the flexor sublimis digitorum. Sensory disturbances at the present time only over the radial and musculospiral

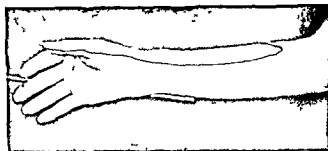


Fig. 299—Area of sensory disturbance remaining six months after lesion of posterior and outer cords

We have here a regenerating lesion of the posterior and outer cords (Fig. 299)

CASE IV —K. B. wounded October 13 1918 gunshot wound of left axilla. Sustained immediate paralysis of his forearm. On February 22 1919 showed marked atrophy of the thenar and hypothenar eminences of all the muscles of the arm and forearm. Fingers and thumb show no movement except slight flexion of the thumb at the distal joint and of the fifth finger at the metacarpophalangeal joint. Flexion and extension of the wrist abolished supination weak pronation abolished. Sensory disturbances present over the ulnar median and radial. At the present time the extensors of the wrist pull 5 pounds flexors 3 pronators 5 supinators none triceps 11 common extensor 20 grams extensors of the thumb 50 grams flexor profundus digitorum 3 pounds interossei none opponens none adductor pollicis 2. Sensory disturbances over the distribution of the ulnar the median and radial most marked in the radial.

and exit over the spine of the scapula. He sustained a fracture of the left acromion process of the scapula. Upon examination he shows paralysis of the deltoid biceps very marked weakness in the supinators and in the muscles supplied by the subscapular nerves. There is analgesia anesthesia and loss of temperature sense over the fifth sixth and seventh cervical segments.

This case would be classified as an upper muscle type or an Erb's palsy. It could likewise be termed a combined partial posterior and outer cord lesion of the brachial plexus. The probability is that in this case the soldier sustained a lesion of the primary cord of the brachial plexus (Fig. 798).

CASE II—C. S. wounded October 5, 1918. Machine-gun bullet entered shoulder joint above scapula and lodged in neck above clavicle. The entire right arm completely paralyzed immediately following injury. In one month began to move fingers and at the same time sensation began to return. He then showed complete paralysis of the infra pinatus supra pinatus deltoid biceps trapezius triceps partially paralyzed supinator very weak extension and flexion of wrist moderately weak grip fair. At the present time he has motion in every muscle of the upper extremity and only weakness where paralysis formerly existed.

In this case we are dealing with a lesion of the posterior cord combined with the outer cord. Regeneration has occurred to such a degree that sensory disturbances are present only over the radial distribution.

CASE III—L. P. wounded October 18, 1918. Verdun gun shot wound of right shoulder entrance in a line below the clavicle and inside the shoulder joint exit 2 inches to the right of the spine over the eighth dorsal vertebra. Arm hangs helplessly by the side the hand is cold and moist. There is marked atrophy of the upper arm and deltoid the muscles of the forearm and palmar interossei. There are sensory disturbances over the distribution of the musculocutaneous internal cutaneous median and radial. At the present time it is noted that the deltoid is

sixth is but little involved. That over the area supplied by the internal cutaneous and ulnar show the greatest involvement.

We are here dealing with a combination of a lower cord with a posterior cord lesion (Fig. 301).



Fig. 301.—Combination of lower end posterior cord lesion. Note atrophy of intrinsic muscles of the hand, extension of first phalanges of fingers and flexion of two distal phalanges; the metacarpal of the thumb is drawn out and backward. Shaded area represents region of sensory changes.

CASE VI.—H. R. wounded August 31, 1918, machine gun bullet entered below the right coracoid process and had its exit below the angle of the scapula. At the primary operation the ulnar nerve was sutured. Examination January 18, 1919, showed slight atrophy of the muscles of the right shoulder girdle, moderate atrophy of the muscles of the arm and forearm, marked atrophy of interossei and lumbricales and of the hypothenar eminence. This is paralysis of the interosseal flexors of the fingers, the opponens, and the muscles of the hypothenar eminence. The pronators are weak, palmaris longus is weak, the flexors of the wrist are weak, the supinators moderately weak. Sensory disturbances over the distribution of the ulnar and median with the sensory syndrome of compression.

We are dealing here with a lesion of the posterior cord combined with a lower (Fig. 300)



Fig. 300 — Note atrophy of thenar and hypothenar eminences.

CASE V — H. M., wounded October 14, 1918, gunshot wound. Bullet entered 2 inches above and to the outside of the angle of the scapula and had its exit just above the middle of the clavicle. On February 15, 1919, examination showed the arm to hang helplessly by the side with wrist-drop, marked vasomotor change and edema of the hand. There was atrophy of the supra- and infraspinatus, the serratus magnus, the pectorals, the deltoid, upper and lower arm, thenar and hypothenar eminences, and palmar interossei. There was marked weakness in the deltoid, teres minor, and flexors of the wrist. The extensors of the wrist were paralyzed. All function was lost in the fingers except slight flexion of the distal joint of the fifth finger and slight adduction of the thumb. Sensory disturbances were present over the distribution of the internal cutaneous, ulnar, musculospiral, and circumflex nerves. On April 1, 1919, there was reaction of degeneration in the deltoid, supinator, and the other muscles supplied by the musculospiral, the median, with the exception of flexor carpi radialis and the ulnar. It is notable that the biceps was preserved. At the present time the paralysis involves the same distribution but to a lesser degree. The sensory changes show an involvement of the fifth, sixth, eighth, and first dorsal roots, the distribution over the

unconscious for six hours Had ligation of the left jugular vein Upon regaining consciousness found a left sided hemiplegia Forty days after injury a piece of shell casing was removed from the region of the fifth and sixth cervical vertebræ The wound of entrance was in the left anterior triangle of the neck At this time all movements of the left arm are possible but weak The deep reflexes of the arm when patient is relaxed are about the same as the right There is slight ataxia of the left arm and leg Marked hysterical spasm of the left hand On the right side of the body below the level of the first dorsal there is diminution of temperature sense The deep reflexes of the left leg are slightly greater than the right

We are dealing here with a recovered Brown Séquard paralysis showing functional spasm of the hand which might be confused with a brachial plexus lesion

It might be said of Brown Sequard paralyses in general that the cases which have been observed in the war have borne out the truth of the observations of Gordon Holmes relative to the crossing of the sensory tracts Of the greatest clinical importance is the fact that brachial plexus lesions as a whole tend to recover spontaneously and that lesions of the spinal cord in the cervical enlargement whether or not associated with brachial plexus lesions have a high percentage of spontaneous recoveries which contraindicate early operative interference

There remains but one thing to which I call your attention and that is the necessity of careful observation before and after operations This is necessary so that the reports of incredibly rapid recoveries of the functions of peripheral nerves following nerve sutures be properly avoided Such reports have never withstood the test of careful analysis and are due only to improper study This care must be exercised both in the examination of the motor and of the sensory function In the motor sphere it must be remembered that many supposedly antagonistic muscles have under certain conditions protagonistic functions Examples of this mechanism are manifold some of which I may mention Extension at the wrist may be simulated by passive movement of extension through strong flexion of the fingers and ad

the hospital 20 had already sufficiently recovered to be sent to convalescent and replacement camps

One of the interesting things observed in lesions of the brachial plexus has been the coincidence of lesions of the spinal cord with these injuries. These spinal cord lesions have been of two types one fortunately the more frequent occurring immediately with the brachial plexus injury in which the soldier falls with paralysis of his four extremities which rapidly develops into hemiplegia of the spinal type and therefore a Brown Sequard paralysis. When examined at this time there is found in addition to the brachial plexus palsy on the side of the injury paralysis of the leg on the same side with slight loss of touch on that side loss of tendon and vibration sense and on the opposite side loss of pain and temperature sense. At times paralysis of the opposite arm of a root type may persist for a certain period. In a relatively short time the paralysis of the legs disappears leaving only a brachial plexus palsy. The following case will illustrate

I F wounded September 12 1918. Shrapnel entered the back of the neck traversing it from left to right. He had immediate paralysis of all four extremities. Upon examination September 19 1918 he showed paralysis of the left arm and forearm of an upper brachial plexus type and paresis of the left leg. There was weakness in the right arm. There was involvement of the left cervical sympathetic analgesia anesthesia and loss of temperature sense in the left arm over the area supplied by the fifth sixth seventh and eighth cervical segments and in the right arm analgesia and loss of temperature sense only in the seventh and eighth cervical and first dorsal segments. On the right side he showed analgesia and loss of temperature sense over the rest of the body below this area. On the left side he had hyperesthesia below the second dorsal segment. This case within a period of two months recovered all function with the exception of the brachial plexus lesion of the left side.

The next case shows a combination of Brown Sequard paralysis which has recovered with functional spasticity of the arm which now resembles superficially a brachial plexus lesion.

J H wounded August 7 1918 by high explosive and was

CLINIC OF CAPTAINS FRANK A NORRIS AND RUDOLPH S REICH

GENERAL HOSPITAL No 28, FORT SHERIDAN, ILLINOIS

THE FATE OF FOREIGN BODIES IN TISSUES

Summary Frequency of foreign bodies in the tissues of wounded soldiers
foreign bodies usually innocuous exceptional cases indications for re-
moval demonstration of typical cases

FOREIGN bodies play a very small part in the late surgery of war wounds. From December 1 1918 to April 1 1919 we have collected 184 cases which comprise about 10 per cent of all patients in this hospital with wounds. The foreign bodies vary in size from minute particles to pieces 5 to 10 cm. in length and have been in the tissues for a period of six to ten months and only seventeen primary operations have been necessary for their removal. Some have been removed at the time of operating for osteomyelitis or other conditions but as secondary affairs. The majority cause no disability whatever and have not interfered with results in bone transplants nerve sutures and other surgery. In our experience here they play practically no part in the pathology of osteomyelitis unless they are in the infected field or communicate by a sinus. In the great majority of instances they are encapsulated in the tissues and are innocent sequestra being the whole disturbing factor in about 90 per cent of the cases.

Of the above total 5 cases have foreign bodies in the brain substance of which 3 have been removed. Two were removed preliminary to bone transplants to fill defects in the skull, the first from the frontal region the second from the temporal region just anterior to the petrous portion of the temporal bone, and neither of these cases had symptoms as the result of their foreign bodies. The third case had a fragment of shell in the left parietal

duction of the thumb. The proximal phalanges may be tensed by the action of the interossei. The terminal phalanx of the thumb can be extended by the flexor brevis pollicis and the abductor brevis pollicis. These movements of course would confuse one in a case of musculospiral palsy. In ulnar palsy a substituted movement for adduction of the thumb is produced by the action of the opponens pollicis and the flexor brevis pollicis as well as by the extensor longus pollicis when the wrist is strongly extended. In combined lesions of the ulnar and median flexion at the wrist can be produced by the abductor longus pollicis.

The sensory functions owing to the profusion of anastomoses must receive careful analysis. Immediately after injury the complete physiologic area of a nerve may be completely anesthetic but after a time but a small portion of this area shows complete sensory loss. Only some of this return of function is due to regeneration. A great deal is dependent upon the vicarious functioning of the anastomotic nerves. That this is true is shown by the fact that if in a lesion of a peripheral nerve where there had been observed complete sensory loss in the ordinary physiologic distribution of the nerve this area shows shrinkage a subsequent section of the nerve does not again produce complete sensory loss in the original area. It can readily be seen that unless a careful examination be made prior to operation the relatively small amount of sensory disturbances may be interpreted as a sign of nerve regeneration. Notable among such cases are the injuries of the musculospiral nerve.



Fig. 303—Foreign body in parietal lobe posteriorly, with bone defect in frontal region



Fig. 304—Foreign body in neck of femur with encysted abscess

lobe posteriorly which had driven in with it six small pieces of bone. An infected sinus was formed communicating with bone and shell. Immediately following injury hemiplegia resulted and later epileptic seizures developed. Two previous attempts had been made at removal. The two remaining cases had been associated with hemiplegias and will be removed at some future date.

In the thorax 15 cases have been found only one of which has been removed and that from the pleural cavity because of constant mechanical irritation. Two have bullets in the pleural cavity and are associated with hemothorax which required aspiration. There was no indication for removal as both patients improved without infection developing. Five were localized in the lung substance one with active empyema but there was no communication with foreign bodies. In the remaining 7 cases the missiles were situated in the thoracic wall where they caused no annoyance.

Two cases had foreign bodies in the posterior muscles of the neck in which the wounds healed without infection or any later trouble. Of 4 cases of foreign bodies in the lumbar region 2 healed without difficulty the third was complicated by osteomyelitis of the ilium and in the fourth it was necessary to remove four pieces of shell from the subcutaneous tissue because of mechanical irritation.

Out of 10 cases of foreign bodies in the pelvis one was removed from a sinus leading from the urethra. In the second case a

— f l m n h

sphincter control. In this case healing has not yet occurred. The 7 remaining are healed.

In the upper extremity 65 cases have been removed 17 about the shoulder 24 in the arm 12 in the forearm and 12 in the hand. In the lower extremity 81 cases were found which included 34 in the thigh 29 in the leg and 18 in the foot. In the extremities 14 cases had osteomyelitis and all have been operated and are doing well with foreign bodies still in their tissues. Two



Fig 303—Foreign body in parietal lobe posteriorly with bone defect in frontal region



Fig 304—Foreign body in neck of femur with encysted abscess

cases had as many as forty fragments of shell in the tissues of the thigh which were encapsulated. Two cases were operated with foreign bodies in the buttocks on account of pain from pressure. In one instance a piece of high explosive shell extended from the lateral condyle of the femur into the knee joint and was removed.



Fig. 303.—Foreign bodies about osteomyelitis not interfering with healing.

There are two men who have foreign bodies encapsulated in the soft tissues of the lower jaw which have produced no symptoms. One case in which a foreign body had penetrated the great trochanter caused ankylosis of the hip-joint. The wound had been healed for five months. An arthroplasty was indicated and when the great trochanter was sawed through a pus pocket was found about a piece of shell. The shell was removed and of



Fig. 306—Foreign body encapsulated about osteomyelitis



Fig. 307—Foreign body in lung substance with empyema—no communication with piece of shell

cases had as many as forty fragments of shell in the tissues of the thigh, which were encapsulated. Two cases were operated with foreign bodies in the buttocks on account of pain from pressure. In one instance a piece of high explosive shell extended from the lateral condyle of the femur into the knee-joint, and was removed.



Fig. 30c.—Foreign bodies about osteomyelitis not interfering with healing.

There are two men who have foreign bodies encapsulated in the soft tissues of the lower jaw which have produced no symptoms. One case in which a foreign body had penetrated the great trochanter caused ankylosis of the hip joint. The wound had been healed for five months. An arthroplasty was indicated and when the great trochanter was sawed through a pus pocket was found about a piece of shell. The shell was removed and, of



Fig 306—Foreign body encapsulated about osteomyelitis



Fig 307—Foreign body in lung substance with empyema no communication with piece of shell

course, operation deferred. This is the only case of latent infection about a foreign body.

In conclusion, it may be said that the indications for the removal of foreign bodies are,—when they produce mechanical irritation, pressure, or when they are located in the infected field. From the above cases, which have been carrying foreign bodies for a period of from six to twelve months, it would seem that



Fig. 308.—Foreign body about osteomyelitis not interfering with healing.

metallic foreign bodies cause very little trouble in the tissues. They are not porous, therefore do not harbor organisms and usually become sterile and encapsulated, while sequestra are porous, harbor organisms, and consequently must be removed. When foreign bodies cause mechanical irritation in the pleura or are adjacent to nerves, as for instance in the sciatic, resulting in causalgia, or when they are in close approximation to a blood



Fig. 309—Foreign bodies in hand and forearm without symptoms

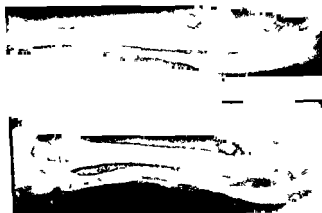


Fig. 310—Bone transplant of ulna with two pieces of shell in tissue

vessel causing erosion of its wall it is obvious that removal is necessary. When a piece of shell is free in a joint or projects into it, *serious damage results and it must be removed*. Removal is also indicated when foreign bodies are located about points of pressure, most commonly the sole of the foot, the palm of the hand, the back, and buttocks. In the brain removal seems advisable as the foreign bodies are associated with hemiplegia, epilepsy, and mental defects and there is danger of late irritation from cyst formation and consequent pressure.

In conclusion we present the following x ray plates as examples of typical cases of foreign bodies in the tissues. In the light of the preceding discussion these plates are practically self-explanatory (Figs. 303-310).

CLINIC OF DRS ARTHUR DEAN BEVAN AND THOR C ROTHSTEIN

PRESBYTERIAN HOSPITAL

BRAIN TUMOR

Summary A patient giving a history of headaches and epileptiform attacks extending over a period of years weakness of the left arm and leg discovered on examination the diagnosis significance of epileptiform attacks headache in brain tumor not always constant localization of lesion in right motor area technic of exploratory operations on the brain necessity of co-operation between neurologist and surgeon prognosis in brain tumor

DR BEVAN I shall operate upon a patient this morning upon whom Dr Thor C Rothstein has made a diagnosis of brain tumor situated in the right motor area We shall make this a joint clinic Dr Rothstein will present to you the diagnostic side of the case and on the basis of his diagnosis I shall proceed to operate and expose the area in which he believes the tumor is located If the tumor is found, we shall remove it if that is possible, or do the palliative operation of decompression if the conditions of the case seem to make such a procedure desirable Dr Rothstein will give you the diagnostic side of the case

DR ROTHSTEIN The patient is a married woman, forty years of age She belongs to a healthy family It is, however, possible that her grandmother, who died at the age of thirty, suffered from epilepsy, but our information about the grandmother is too fragmentary to allow any decided opinion about the nature of her disease The patient herself has, ever since her childhood, suffered from periodical attacks of headaches (sick headaches) and after the menstruation started in her thirteenth year, she frequently suffered from severe headaches during the menstrual periods The attacks of headache would

vessel causing erosion of its wall it is obvious that removal is necessary. When a piece of shell is free in a joint or projects into it serious damage results and it must be removed. Removal is also indicated when foreign bodies are located about points of pressure most commonly the sole of the foot, the palm of the hand, the back and buttocks. In the brain removal seems advisable as the foreign bodies are associated with hemiplegia, epilepsy and mental defect, and there is danger of late irritation from cyst formation and consequent pressure.

In conclusion we present the following x-ray plates as examples of typical cases of foreign bodies in the tissues. In the light of the preceding discussion the x-ray plates are practically self-explanatory (Figs. 303-310).

was not increased. The Lange test did not show any reduction of goldsol solution and only 4 to 6 cells were found in 1 mm Wassermann test on blood and spinal fluid was negative. After the spinal puncture she suffered from severe nausea, vomiting, and violent headache, which lasted for more than a week although she was kept in bed. As she suffered from epileptic attacks and always had been suffering from severe migraine the headache was not at this time considered of any sinister significance.

This is in short, her history up to March, 1915. The history and the result of the examination left me, as a last choice, the somewhat unsatisfactory diagnosis of so called genuine epilepsy.

I did not see her from March, 1915 until March, 1919, when she again entered the Presbyterian Hospital and Dr. J. B. Herrick referred her to me. Her history during this interval is shortly, the following. As long as she adhered to the régime mapped out for her and took bromids, averaging about 45 grains in twenty four hours, she was free from convulsions and the "petit mal" attacks as well as the migraine attacks were few, but as soon as she stopped the bromids she would have numerous attacks of "petit mal" the migraine attacks would become as they used to be and the convulsions would reappear. In 1917 for some reason she stopped taking medicine. The convulsions now became more frequent but gradually they occurred less and less frequently. The "petit mal" attacks remained frequent. During the year 1918 she had one convulsion about every three months but the "petit mal" attacks occurred five to fifteen times a day.

In December 1918 a new feature was added to her sufferings. Immediately after some of the petit mal attacks she would have severe pain starting in the back of the head and spreading up over the top of head until it reached the forehead. The pain only lasted a short while. When she first started to suffer from these intense pain attacks they occurred only after a couple of the "petit mal" attacks each day. Gradually the pain attacks increased in number and intensity and vomiting would occur during them. One month after the onset of the pain attacks they had increased to such a number that they had become

last about twenty four hours, and were frequently severe, and she usually vomited during the attack. In the intervals between the headache attacks she enjoyed good health.

She married and when she became pregnant (in her thirtieth year) she suffered intensely from headaches, vomited continuously, had to keep to her bed and aborted in the second month of her pregnancy.

After the pregnancy her attacks of headache became more regular, coming on practically every month at the time of menstruation. In June 1913 she was then thirty four years old she had a typical epileptic convulsion coming on in the night while she was sleeping. This convulsion was followed by a severe headache which lasted for fully twenty four hours.

In December 1913 she had a second convulsion also in the night. During the year 1914 she had four convulsions, one in each of the months of March, June, July, and August, all of them were preceded by a peculiar epigastric sensation, the first three coming on in the night and the fourth in the afternoon. All the convulsions were followed by severe headaches lasting as in the case of the first convulsion for about twenty four hours. Between the convulsions she suffered from small attacks in which consciousness was not lost. She would suddenly experience a peculiar sensation in the epigastrium, become pale and feel "stupid." After a few seconds the sensation would pass off and she would feel well. Of such attacks of "petit mal" she would have sometimes several in each day.

In 1914 she was placed upon a treatment consisting of diet and bromids. The convulsions stopped but the attacks of "petit mal" and of headaches did not disappear but became much less frequent.

In March 1915 she entered the Presbyterian Hospital of Chicago where I examined her. The pupils were equal and reacted normally. Eyegrounds were normal. No paralysis was found in any of the muscles of the body. The reflexes were all normal and the sensation was normal. A slight Darbyshire symptom was present but pulse was normal and no tremor existed. The spinal fluid was free from globulin and albumin.

was not increased. The Lange test did not show any reduction of goldsol solution and only 4 to 6 cells were found in 1 mm Wassermann test on blood and spinal fluid was negative. After the spinal puncture she suffered from severe nausea vomiting and violent headache which lasted for more than a week although she was kept in bed. As she suffered from epileptic attacks and always had been suffering from severe migraine the headache was not at this time considered of any sinister significance.

This is in short her history up to March 1915. The history and the result of the examination left me as a last choice the somewhat unsatisfactory diagnosis of so called genuine epilepsy.

I did not see her from March 1915 until March 1919 when she again entered the Presbyterian Hospital and Dr J B Herrick referred her to me. Her history during this interval is shortly the following. As long as she adhered to the regime mapped out for her and took bromids averaging about 45 grains in twenty four hours she was free from convulsions and the petit mal attacks as well as the migraine attacks were few but as soon as she stopped the bromids she would have numerous attacks of petit mal the migraine attacks would become as they used to be and the convulsions would reappear. In 1917 for some reason she stopped taking medicine. The convulsions now became more frequent but gradually they occurred less and less frequently. The petit mal attacks remained frequent. During the year 1918 she had one convulsion about every three months but the petit mal attacks occurred five to fifteen times a day.

In December 1918 a new feature was added to her sufferings. Immediately after some of the petit mal attacks she would have severe pain starting in the back of the head and spreading up over the top of head until it reached the forehead. The pain only lasted a short while. When she first started to suffer from these intense pain attacks they occurred only after a couple of the petit mal attacks each day. Gradually the pain attacks increased in number and intensity and vomiting would occur during them. One month after the onset of the pain attacks they had increased to such a number that they had become

practically constant and remained so for four days. Then she was free from the pain attacks for four to five days, but they came on again and gradually increased in frequency until she, after another four or five weeks, had the headache constantly for a whole week. Again she had a few days of relief before she entered into a third period of gradual increase. She entered the hospital during this period. During the week she has been here she had intense headache constantly for three days, followed by a day free from headaches. But next day she had intense headache for several hours. Vomiting has occurred a couple of times during the headache attacks. During the last two months both she and her husband have noticed a tremor and shaking of her left arm, coming on sometimes when she was using the arm. They both, however, stated that she had been able to use the arm practically as well as before the onset of the tremors.

Physical Examination—The patient is well nourished and strongly built.

The pupils are wide, the right one somewhat wider than the left. Both pupils react to light and accommodation.

Eyegrounds show moderately choked disks. Vision is normal. There is a distinct but partial paralysis of the left half of the face.

The left eye shows lagophthalmos and cannot be closed as strongly as the right. The left corner of the mouth cannot be moved voluntarily as far to the side as the right corner of the mouth. When she laughs emotionally the left corner of the mouth moves nearly as far to the side as the right. The left masseter does not form as great a protrusion as the right when she bites. The left half of the soft palate hangs a little lower than the right half, but both halves move about equally well. The outstretched tongue does not deviate from the middle line.

The left arm is markedly weaker than the right and some resistance is felt to passive movement of the left arm, especially to extension of the wrist. Complicated movements with the fingers are not executed as well with the left hand as with the right. When she executes movements with the left arm a tremor of rather large oscillations occurs especially at the beginning and

the end of the movement This tremor is at times much more marked than at other times The right arm also presents some tremor when executing movements but not as markedly as the left

Pointing—for instance, finger to nose—is not quite accurate with the right hand but markedly inaccurate with the left

The tendon reflexes of the arms are lively, but a little more lively in the left arm than the right

The abdominal reflexes are present on both sides, but more easily elicited on the right side than on the left

At times the strength of the left leg seems less than that of the right leg, at other times the strength of both legs seems equal Patellar and Achilles' tendon reflexes are lively on both sides and about equal on both sides The Oppenheim, the Gordon and the Babinski reflexes are negative (normal) on both sides There is no tremor or ataxia present in either leg The patient has never noticed any difference in the strength of her legs

The testing of the sense of smell gives no clear results

Sensation to pain temperature and touch is normal on all parts of the body Astereognostic sense is not decreased on either side

Percussion on the right frontal bone in region of the temple causes a very painful sensation while percussion on any other part of the skull does not cause any such pain

The temperature has been normal

A spinal puncture has not been made recently, as the patient has a great fear of this operation on account of her experience in 1915

We have then before us a patient who suffers from symptoms of increased intracranial pressure, viz severe headaches, vomiting and choked disks At least one of the symptoms, the headache, has shown a gradual increase in intensity and constancy since three months

As we can practically with certainty exclude syphilis (she has never shown any specific symptoms of this disease and at least twice the serologic tests have been negative to syphilis),

and as we have no evidences of any other infectious disease, the cause of the increased intracranial pressure most likely is an intracranial growth.

In our examination of the patient we demonstrated a focal symptom—the left sided hemiplegia—which demonstrated that the brain itself must in some way be involved, and also gives us some information about the locality of the growth.

A hemiplegia may be caused by lesions in several parts of the brain but we have before us an upper neurone lesion and as the paralysis of the face and the arm is localized on the same side the lesion must lie above the nucleus of the facial nerve. The hemiplegia presents, however, a peculiarity in distribution. The face and the arm are about equally affected, while the leg is hardly affected at all. Such a distribution of paralysis we may find in lesions of the motor cortex. But it is not likely that we will find the tumor involving the motor cortex itself because a tumor involving the motor cortex itself would cause a greater amount of paralysis than is present in this case. Furthermore, against a localization of the tumor in the motor cortex speaks the absence of Jacksonian epilepsy. It is more likely that the tumor is situated in the proximity of the motor cortex, exerting some pressure upon or slightly involving the motor area. We cannot assume that the tumor is situated posteriorly to the motor area, because in that case the sensation should have been altered on the left side of the body, but we have been unable to demonstrate any decrease in sensation on the left side. An assumption that the tumor is situated anteriorly to the motor area is, on the other hand, plausible if we assume that it is located in such a way that it presses upon or slightly involves the center of the face and the arm. There are no reasons for us to assume that the tumor lies deeper down in the brain pressing upon the capsula interna, thus causing the hemiplegia. The type of hemiplegia (the leg being practically free from paralysis) present does not correspond to the hemiplegia present in tumors involving the capsula interna. Neither have we any reason to think that the thalamus is involved. The most likely place to find the tumor I therefore consider to be the part of the frontal lobe which lies

anteriorly to the centra of the arm and the face. The patient presents some symptoms which I have several times found in tumors of the frontal lobe. I refer to the tremor and the ataxia of the left arm but these symptoms are also found in lesions of other localities. I cannot say with any degree of certainty if the tumor is a cortical or a subcortical tumor. However, the pain caused by percussion of the right frontal bone can be considered a hint that the tumor may have reached the surface of the brain and involved the meninges.

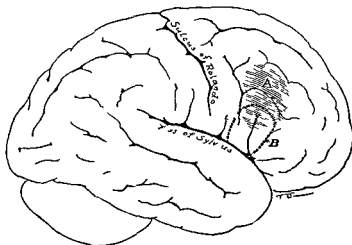


Fig. 311.—Diagram showing *A* the area considered the most likely location for the tumor and the point at which it probably extended to the surface of the brain. *B* the actual location of the tumor as disclosed at operation. It involved the meninges at this point.

As we have a hemiplegia of the left side the tumor must, of course be situated in the *right hemisphere*, and I feel convinced that the tumor is located in the right frontal lobe. The distribution and character of the paralysis and the absence of sensory disturbances make the region anterior to the arm and face centra the more likely localization. The ataxia, the tremor, and the pain caused by percussion of the right frontal bone supports to a certain extent, this localization (Fig. 311).

The interesting question arises. How long has the tumor

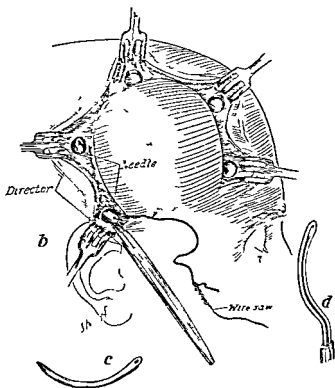
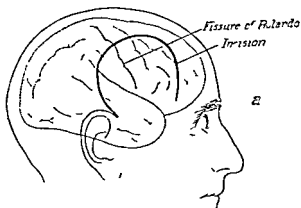


Fig 31

existed in the brain of the patient? Had the tumor already started to grow in 1913 when she had her first epileptic attack or is the tumor an incidental affair which had nothing to do with the development of the epilepsy? I suspect that the tumor existed before 1913 and for all that we know may have existed ever since her birth but I am unable to give any convincing reasons for this belief

DR BEVAN The patient has been properly prepared the head very carefully shaved and sterilized She is now thoroughly anesthetized under drop ether and we shall proceed with the operation As Dr Rothstein explained to you we shall expose the area of the brain in front of the Rolandic fissure on the right side and expose also if necessary the frontal lobe and the temporosphenoidal lobe I shall therefore plan an osteoplastic flap irregularly about 3 inches in diameter exposing posteriorly the Rolandic area and the area in front of the center of the fissure of Rolando I am making an omega shaped incision through the scalp tissue large enough to enable me to elevate a bone flap about 3 inches in diameter (Fig 312 a) As I proceed I shall describe to you the technic which we have adopted in this clinic As I divide the scalp tissue you will see that these tissues are very vascular and it is necessary to apply a large number of artery forceps to control the bleeding There was a time when we attempted to control hemorrhage from the scalp with a rubber tube tied tightly around the head endeavoring to obtain the same effect with this rubber constriction that we do in a bloodless operation of the extremities My experience however has been that it is very difficult to control the bleeding from the scalp tissues in this way and for a number of years I have discontinued the use of the rubber constrictor and have relied entirely upon a large number of artery forceps accurately applied picking up each bleeding point on both sides of the incision As far as possible we do not grasp

Fig 312—*a* Incision for exposure of motor area of cortex *b* Soft tissues retracted trephine openings made and G. G. saw being carried beneath segment of bone between trephine openings *c* Broad flat blunt curved needle used to carry wire saw into position *d* Grooved director

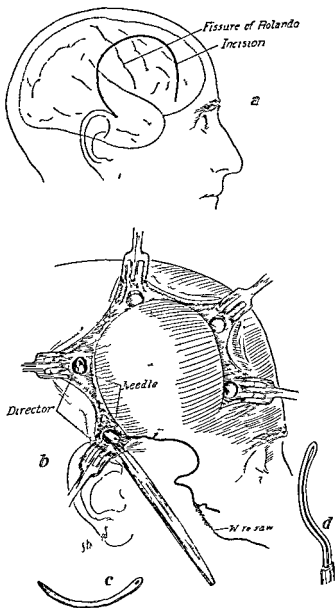


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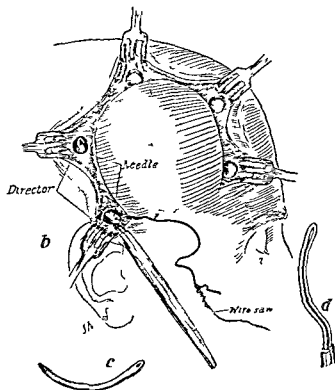
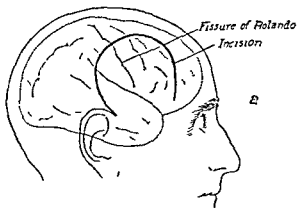


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Fig 312—*a* Incision for exposure of motor area of cortex. *b* Soft tissues retracted, trephine openings made and Gigh saw being carried beneath segment of bone between trephine openings. *c* Broad flat, blunt curved needle used to carry wire saw into position. *d* Grooved director.

the integument in the artery forceps but the superficial fascia just beneath the integument in which most of the vessels are situated. It is however occasionally necessary to clamp the edge of the skin and I do not hesitate to do this where it is required as there is little danger of necrosis from this procedure even though the clamps are allowed to remain in position for a half hour or more. The hemorrhage is now completely controlled. We have employed in our clinic for a long time a trephine and Gigli wire saw to make our osteoplastic flap. This is in a way a rather simple method and rather time consuming and yet I believe that except for the fact that it is time-consuming it is the best method that has so far been developed. The use of the electrically driven saw for skull work has not been very satisfactory to us and such apparatus is complicated and somewhat difficult to sterilize and is very apt to get out of order, and therefore in a general surgical clinic where but a few head cases are done each month I am inclined to advocate the use of the trephine and wire saw in making the osteoplastic flap.

Taking a small trephine about $\frac{1}{2}$ inch in diameter I make five trephine openings. The skull in this case is particularly thick and the making of these trephine openings rather tedious. I do not believe, however that the great thickness of the skull has anything to do with the pathologic condition. We have found that skulls vary greatly in thickness independent of the pathologic condition and that the thickness seldom has any relationship to the disease process within the cranial cavity. Having made these five trephine openings I take a curved grooved director (Fig 312 d) very smooth and blunt and separate the dura mater from the bone in the line between these openings. I now take a blunt curved needle (Fig 312 c) which is used to carry the wire saw under the bone and very gently and very carefully carry the wire saw into one of our trephine openings posteriorly and then out through the trephine opening about 2 inches above (Fig 312 b). My assistant takes a rubber bulb with a glass tube which is filled with normal salt solution and keeps the saw moistened with the solution. Without using too much tension I now begin sawing our first line and

I want to call your attention to the fact that I saw the bone through in such a way as to leave a bevel (Fig 313, *a, b*) so that when we replace the osteoplastic flap there is no danger of pressing the bone down on the dura. You see that it is necessary for me to saw four lines between my five trephine openings. It is well for you to begin one of these operations with three or four new wire saws in readiness because occasionally one of these wire saws will break during the procedure. I have now completed the sawing and shall very carefully elevate my osteoplastic flap. It will be necessary to fracture the bone at the inferior border of the bone plate that I am elevating. I do this with a good deal of care, introducing a periosteal elevator first on one side and then on the other, having my assistant gently make pressure with two periosteal elevators. I take a third periosteal elevator and elevate the upper part of the osteoplastic flap very gently until I can introduce my elevator under the bone. Then grasping the osteoplastic flap with a gauze sponge and asking my assistant to continue the pressure with his two periosteotomes, I elevate the plate until I feel it yield and fracture at its lower point. I immediately take a gauze sponge wrung out of warm salt solution and surround my osteoplastic flap, and then take a pair of volsellum forceps and apply one blade to the bone and one to the scalp tissue, and then clamp the forceps together over the gauze sponge so as to prevent any separation of the bone from the scalp flap. There is little hemorrhage as I elevate the bone flap and as I sponge the surface carefully I find that most of this hemorrhage is from the diploe. I take a piece of Horsley wax and push it gently into the bleeding openings of the diploe and control at once the hemorrhage from that source. There is also a little bleeding from a ruptured branch of the middle meningeal artery. Taking a fine non-cutting needle and a fine piece of catgut I transfix the dura under the meningeal artery and ligate it. At the upper part of the incision there seems to be some hemorrhage from a venous sinus, or rather a vein that leads into the superior longitudinal sinus. This hemorrhage I control with some dry sterile absorbent cotton. The field is now quite dry and bloodless.

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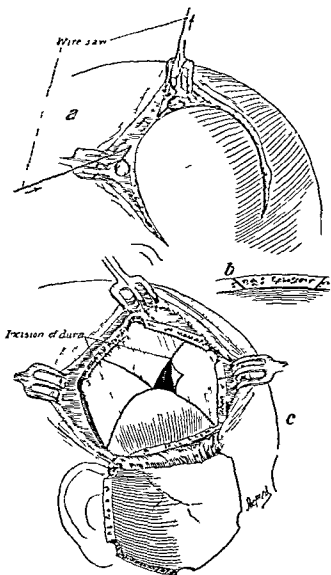


Fig 313—*a* and *b* Galt saw in action note beveling of edge of bone-flap (*b*) *c* Osteoplastic flap turned down and dura incised for exposure of brain.

The dura looks fairly normal. On palpation, however, I am rather inclined to believe that I can detect a difference in consistency between the anterior and posterior portions of the area exposed. I now open the dura with a curved flap incision to which I shall add two linear incisions at the upper point and fold the dura back in four pieces (Fig 313 c). Turning the dura back you see, beautifully exposed a tumor which is well outlined from the normal brain tissue. It is about the color of liver tissue and the differentiation between that and normal brain tissue is very marked as far as the color is concerned. On palpating it, however, with my gloved finger there is not very much difference to be determined by palpation. The tumor tissue if anything, is a little firmer and less yielding than the brain tissue. The tumor involves the area Dr Rothstein so beautifully drew for you before I opened the skull. It involves the area in front of the middle third of the Rolandic fissure and has continued forward into the frontal lobe. Posteriorly, the tumor is irregular, about the size of a silver dollar at least and it involves about that much of the cortex. The depth of the tumor is, of course, yet uncertain and unknown to us. Anteriorly the tumor fades into brain tissue and there is no sharp line of demarcation. Taking a blunt, well rounded periosteotome I attempt beginning posteriorly to find a line of cleavage between the tumor and the normal brain tissue (Fig 314). You see that the tumor bleeds very easily, and as I continue the separation with the greatest possible care the hemorrhage is so great that I have to stop and pack the wound with dry absorbent cotton and use a slight amount of pressure to control it. Leaving the cotton in for about five minutes I now remove it, the hemorrhage has ceased and I continue the effort to enucleate the tumor. I am able to remove several cubic centimeters of the tumor, but as I continue the separation anteriorly and inferiorly I find that the tumor becomes diffuse and that it is impossible to differentiate it from the brain tissue. It will be impossible therefore, for me to make a clean and complete enucleation of this growth. Dr Rothstein after looking at the tumor, tells me that, from the gross appearance, he believes it is an endothelioma and that if

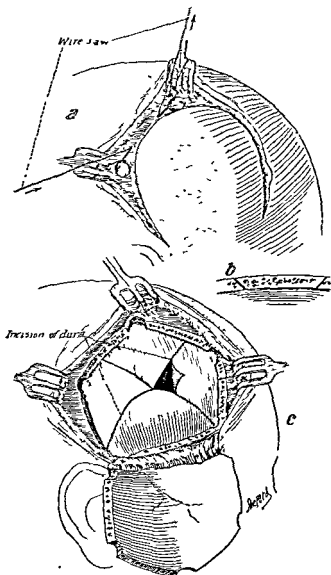


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possible we should remove it. You all realize that removing a tumor from the brain as we are doing now is a very different proposition from removing a tumor from the breast for instance, because we are anxious to do as little injury as possible to the brain tissue and the sort of block dissection that would be permissible in a breast operation is of course here entirely out of consideration.

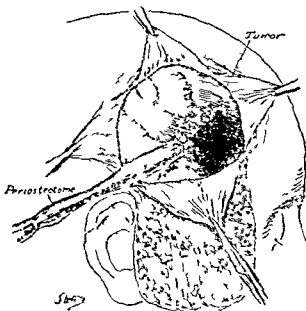


Fig. 314.—Attempt to dissect tumor from brain tissue by blunt dissection with periosteotome.

The patient's condition is fairly good and we have removed the tumor as widely and as thoroughly as I fear we are warranted in doing and yet I am quite certain that we have not removed it all and that the conditions are such as to make it undesirable to proceed further with the dissection. I believe that we should combine this partial extirpation with a decompression operation and I shall therefore remove a large area of bone. I remove with a pair of rongeur forceps the bone in the temporal fossa. This

will give us a permanent opening in the bone about $2\frac{3}{4}$ inches long and about 2 inches wide and I shall not close the dura mater. I obtain in this way the full effects of a decompression operation. I replace my osteoplastic flap and remove the artery forceps from the edges of the incision and approximate the incision with seven or eight fine silkworm gut sutures and close the balance very accurately with fine silk. We shall employ no drainage. We shall dress the wound with dry sterile gauze and a sterile gauze roller accurately applied and over this a starch bandage to prevent any displacement of the dressings. I want to say that I believe this dressing should be changed at the end of twenty four hours and the silkworm stitches removed at that time. Three or four days later every other one of the interrupted black silk stitches should be removed and the balance removed by the sixth or seventh day. The patient is in very good general condition at the close of the operation.

After history — Histologic examination showed that the tumor was an endothelioma. The patient was unconscious for the greater part of the first twenty four hours but gradually regained consciousness so that she could take liquids and some nourishment. Wound healing was complicated by the escape of cerebrospinal fluid and some brain tissue the stitches were removed as I had suggested first the silkworm gut and then the black silk in two different sittings. After operation there was paralysis of the left side especially of the left hand.

As to the ultimate prognosis one must regard the operation as palliative. From the standpoint of accuracy of diagnosis the case is most satisfactory but from the standpoint of an ultimate and complete recovery however one must regard it as a case in which the surgical therapy is simply palliative and if of any benefit of temporary benefit. The epileptic convulsions may be controlled or prevented entirely and the headaches will probably be relieved and the eyesight improved but the infiltrating character of a part of the growth makes it certain that there will be a continued growth of the tumor which will lead ultimately to the death of the patient. Dr Rothstein and I have considered the possibility in this case of using radium or

possible we should remove it. You all realize that removing a tumor from the brain as we are doing now is a very different proposition from removing a tumor from the breast, for instance, because we are anxious to do as little injury as possible to the brain tissue, and the sort of block dissection that would be permissible in a breast operation is, of course, here entirely out of consideration

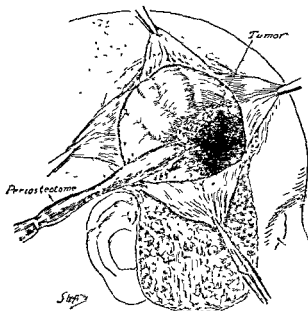


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it is fact, limits the number of satisfactory cases, and it is a condition which no amount of improvement in diagnosis or in surgical technic will ever modify, because of these insurmountable conditions we can never look forward in the development of brain surgery to anything like the satisfactory results which we obtain in many other fields notably in the abdomen. It is difficult to be enthusiastic and optimistic about our results in brain surgery and yet I would not want to leave you with feelings too pessimistic or with anything like a hopeless feeling in connection with this work because some of the cases are most brilliant successes, and many of the cases which we cannot cure are very greatly relieved by the palliative operation of decompression. Therefore, it is our duty to continue this work and to give these patients the small possibility of permanent cure and the larger possibility of palliation that modern surgery affords.

of employing the x ray, and I am not sure but what in a similar case it would not be wise to introduce a flat disk with 50 mg of radium at the time of operation and leave it in twenty four hours and see if in that way we could not eliminate the diffuse portions of the tumor that could not be removed surgically. I do not know how much work has been done along these lines, and yet it is certainly a suggestion that might properly be considered and tested out in a group of cases.

I would like to make two comments on the basis of this case first the necessity of handling these cases in general as combined cases by the general surgeon and the neurologist, it being of course often necessary to call in the service of the ophthalmologist or the otologist in the making of the diagnosis. On the whole, these cases must be handled as a piece of team work by the general surgeon and the neurologist. A few of our best men have specialized in neurologic surgery and have become very competent neurologists so that they themselves can dispense with the services of the neurologist and are competent to take complete charge of both the diagnostic and therapeutic side of these cases. It does not however seem probable that there will be developed a specialty of any considerable number of brain surgeons and so naturally for the most part throughout this country and throughout the world in fact these cases will have to be handled in the general surgical clinics by competent general surgeons and their neurologic colleagues.

The second point I would like to call your attention to is a fact well illustrated by this case that even where the neurologist can make an accurate diagnosis it often happens that, even when the tumor is found, it is often so located or of such a character that it cannot be successfully and completely removed so that the patient can be permanently cured and restored to normal. It certainly would be safe to say that considerably less than 10 per cent., possibly not more than 5 per cent., of brain tumors are so situated and are of such character that they can be diagnosed, removed and the patient cured. In other words only from one in twenty to one in ten of all brain tumor cases can be accurately diagnosed, operated upon, and cured. That fact, and I believe

CLINIC OF DR. ARTHUR DEAN BEVAN

PRESBYTERIAN HOSPITAL

MULTILOCULAR CYSTADENOMA OF THE LIVER

Summary A patient twelve years after hysterectomy for fibroid presenting multiple smooth rounded tumors in the upper abdomen differential diagnosis exploratory puncture of cysts and closure without drainage

THE first patient I shall operate on this morning is a woman of about fifty who came to me twelve years ago with a large fibroid of the uterus. I did a hysterectomy leaving simply the cervix and she made a very satisfactory recovery. She had no trouble of any kind until about three years ago when she noticed an enlargement in the upper abdomen in the median line just below the ensiform cartilage. A little later she noticed a second enlargement on the left side about opposite the umbilicus. This seemed to be about the size of an orange and she could outline it very distinctly herself. The enlargement in the midline was more diffuse a firm and bulging prominence between the umbilicus and the ensiform cartilage. Her general health has been good. Within the last three months she has several times had some stomach distress accompanied with an occasional attack of vomiting but she has been able to keep about with her work and has not been incapacitated in any way by her abdominal condition. I have had her under observation for several days and I confess I am not able to make a diagnosis as to the pathology of these enlargements. I have looked up her old hospital record and find that the tumor removed was a fibroid and that microscopic section of it was made showing that it was a simple fibroid and that there was at that time no evidence of malignancy.

I have thought of a number of possibilities. It is natural to think that the tumor which I removed may have been malign

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empty it completely, you see that there are no daughter cysts. I shall now open several more of these cysts, and you see that the second cyst opened has the same sort of clear fluid contents. The third cyst, however, contains a brown colored liquid which is probably the result of hemorrhage into it. Putting my hand into the abdomen I feel a large cyst extending down from the liver on the left side and I can readily bring this out of the abdomen. This is the tumor that we could feel distinctly on the

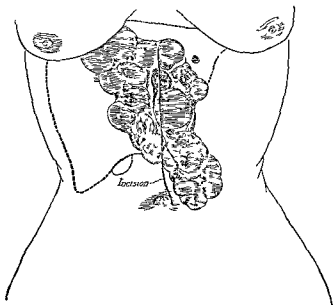


Fig 315—Multilocular cyst of liver. Diagram illustrating approximate form and location of tumor.

left side about opposite the umbilicus. It projects from the lower border of the liver in such a way that I can remove it completely, and I shall do this for the purpose of examining the cyst wall histologically. Extending my examination to the upper surface of the liver, I find between the diaphragm and the right lobe of the liver two very large cysts, as large as my fist. I incise these and empty their contents, and find that they contain the same clear fluid.

nant and that the present tumors are secondary to the primary neoplasm. The length of time that intervened, however, between the hysterectomy and the development of these tumors of course is a strong argument against malignancy. The fact, too, that these tumors have existed now for three years and that her general health is excellent is also a strong argument against their being malignant. I thought in the second place, of the possibility of a papilloma of the ovary and that these were secondary papillomatous growths. A bimanual examination of the pelvis however, fails to reveal any pelvic enlargement and this speaks strongly against such a possibility. In discussing the matter with the patient I told her that I regard the present condition as being independent of the fibroid tumor which was removed twelve years ago, and that I believe that it is a benign and not a malignant process, but as to the exact anatomic location of the present lesion and its pathologic character I am quite unable to come to any definite conclusion.

The patient is now etherized and I shall make a laparotomy between the *ensiform* and the umbilicus and inspect the character of these masses. I have simply told the patient that I believed that an exploratory laparotomy was necessary to make a diagnosis and that this should be done, and if at operation conditions were found which warranted our doing a radical operation of course, we would do this under the same anesthetic.

Opening now into the peritoneal cavity and holding the line of incision apart with retractors, you see that I expose a large multilocular cyst (Fig. 315). I shall extend the incision a little below the umbilicus so as to gain freer access to the lesion. On examining this cyst carefully, you see that it is composed of a number of cysts apparently eight or ten or more in number, and that these involve the liver and invade the area of both the right and left lobe of the liver just beneath the round ligaments. One thinks naturally of the possibility of hydatid cyst of the liver. Walling off this cystic tumor from the rest of the abdomen with several abdominal pads I shall open one of these cysts and inspect its contents. You see as I open this large cyst, a very clear watery fluid pours out and as I



Fig. 316.—Multilocular cyst of liver. a, Round ligament of liver clamped and cut. b, Cyst opened, sponged out, and closed with fine catgut.

This case is a very unusual one and we cannot make an absolute diagnosis even now that we have this multilocular cyst immediately under our inspection. One thinks of several possibilities. First a hydatid cyst without daughter cysts and yet I do not believe that this is a hydatid cyst. The second possibility that occurs to me is a congenital multilocular cystic disease of the liver that has been found in a number of cases associated with cystic disease of the kidneys. I shall therefore examine the kidneys and see if there is any cystic disease of those organs. Introducing my entire hand into the abdomen I examine first the right kidney and find it perfectly normal and then the left kidney and find that is also perfectly normal. I examine also the pelvis and find nothing in the pelvis. The uterus of course is gone having been removed at the previous operation. The gall bladder is normal. The pancreas is normal. The stomach and duodenum are normal. There are no enlarged lymphatic glands to be felt and there is no evidence of any secondary deposits of any sort under the peritoneum. I am forced to the conclusion that this is a multilocular cyst adenoma of the liver involving both the right and left lobes of the liver and the round ligament and that it has developed from an embryonal rest associated with the round ligament and that it is in fact the same pathologic condition that we find in multilocular cysts of the ovary and that it is a true neoplasm from an embryonal rest. A number of such cases have been reported in the literature and I shall therefore venture this diagnosis as the most probable diagnosis of the case until we have obtained a microscopic examination of the cyst wall that I removed.

The particular and important question that now confronts us is what to do with this growth. It is evidently impossible to remove these multilocular cysts from the liver. These so invade both the right and left lobe that an operation that would radically and completely remove them would certainly be fatal to the patient. I am therefore inclined to do what has been done in cases of multilocular cysts of the kidney. I shall split open one after the other of these and empty out the contents with the hope that it will be of some service to the patient in

EPITHELIOMA OF THE LOWER LIP

Summary Technic of plastic operation on lower lip for carcinoma under local anesthesia operation palliative in the majority of cases in the

THE patient whom I shall operate on this morning is this man of about sixty years of age with this large epithelioma of the lower lip. The clinical picture is quite characteristic and leaves no doubt as to the diagnosis, but we have had some sections of the tissue removed under local anesthesia and they show a typical epithelioma. The man has been a pipe smoker for years and we can accept that as being probably the etiologic factor. The Wassermann is negative. His general condition is good for a man of his age. There is no evidence of involvement of the regional lymph glands in the floor of the mouth. They are not palpable.

I want to demonstrate to you the technic which we have employed for a great many years in making a complete lower lip removal. This is the plastic operation which I was taught when I was a medical student by Gunn who then had charge of this clinic. We, however, have modified it in this way, that we are now doing the operation under local anesthesia instead of employing a general anesthetic. I tell these patients so far as the anesthetic is concerned, that we will be able to do the operation with not very much more pain than having a shave, certainly with less sensation than being shaved with a dull razor, and if the technic of local anesthesia is perfect in a case of this kind, there is practically no sensation except the introduction of the first needle. This is not at all an exaggerated statement, because in this operation we can completely anesthetize the entire field so that the patient practically has no sensation whatever. The use of the local anesthetic makes the operation very much simpler and very much safer, and because of the

reducing the size of the neoplasm and relieving the pressure I question very much whether it will be of any definite service but still in view of the fact that the same principle has been applied and occasionally successfully, in polycystic disease of the kidney, I think we are warranted in adopting it in this case in view of the fact that there is no other surgical therapy that might be considered

After splitting open the cysts and emptying out the contents I am going to sew up the cyst wall with fine catgut and attempt to obliterate to a certain extent the cavity of each of the cysts in that way, but I am doing this more particularly so as to leave a perfectly clean smooth peritoneum because I do not intend to introduce any drainage but to make a complete closure of the abdominal incision (Fig 316)

After history —The woman made a good recovery from the operation. The microscopic examination showed the tumor to be a cyst adenoma. I am giving her x ray treatments with the hope that they may prove to be of benefit

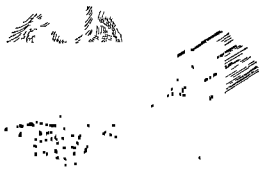


Fig. 317—Carcinoma of lip. a, b Infiltration of tissues with apothecine solution injections indicated by dotted lines

cision divides through the skin, muscle, and mucous membrane. I then add to this two incisions, making a triangle at the corner of the mouth. These last two incisions, however,

addition of adrenalin there is much less hemorrhage under local than under a general anesthetic.

The patient has been thoroughly prepared by having the face carefully washed with tincture of green soap and alcohol. He has used a mouth wash to clean his mouth out thoroughly, consisting of 1 part of alcohol 1 part of peroxid and 2 parts of water. This makes a very efficient mouth wash. The teeth have been thoroughly scrubbed with a brush. They are, however, not in very good condition and later will need the attention of a dentist.

Taking a very fine hypodermic needle with a small syringe I inject about $\frac{1}{2}$ inch from the margin of the epithelioma 20 or 30 drops of apothesine $\frac{1}{2}$ of 1 per cent to which we have added adrenalin sufficient to make it 1:100,000. In the area made by the first injection I now introduce a larger needle and using a large syringe I infiltrate the entire lower lip and pretty extensively, probably the size of a silver dollar, the tissues at the angle of the mouth. I infiltrate also the upper lip and cheek and a narrow triangular area of the cheek just outside of the angle of the mouth and above the angle of the mouth. I infiltrate also the mucous membrane of the lower lip and the tissues well down over the tip of the chin (Fig. 317 *a* and *b*). You will notice that the infiltration is sufficient to distend the lower lip to about twice its normal size and the tissues of the cheek also where we have made the infiltration. Beginning now with a sharp knife and compressing the coronary arteries at the corner of the mouth on the right side I cut out a big V or Y-shaped block of tissue involving almost the entire lower lip going widely at least $\frac{3}{4}$ inch from the epithelioma. You will notice that the patient has no sensation of pain whatever as we remove this big block of tissue. There is very little bleeding. The coronary arteries near the mucous membrane of the lip bleed but are easily grasped with artery forceps and two smaller vessels at the lower part of the incision near the chin also are controlled with artery clamps. I now make an incision at the angle of the mouth directly outward about $\frac{1}{2}$ inch in length. This in

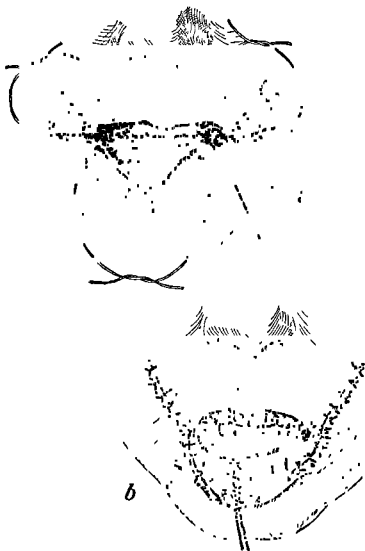


Fig 318—Carcinoma of lip a, Resection made and first sutures placed. Skin and fat only are removed from angles of mouth. The mucous membrane is left b, Suture of inside of lip.

simply include the skin and superficial fascia. I now make the same sort of a triangle on the other side (Fig 318 a). The incisions of the plastic operation are now complete and we are ready to close the defect. This is best done by closing first the triangles at the corner of the mouth. I introduce here one silkworm gut suture at the base of the triangle and tie it. This as you see slides the two flaps toward the median line. I now introduce one silkworm-gut bringing the big V-shaped incision of the lower lip together. The next step of the procedure is to sew the mucous membrane of the cheek and of the skin together at the angle of the mouth making a vermilion border for the new lip. This we shall do with a fine black silk suture. I shall next introduce the skin silkworm-gut suture about the center of the big V-shaped incision of the lower lip. There remains simply the closing very accurately, of the skin of the V-shaped incision of the lower lip with fine black silk suture and then everting the new lower lip and closing very accurately the mucous membrane with four or five silk sutures and introducing two interrupted silk sutures in order to close completely the triangular areas at the corners of the mouth (Fig 318 b). This completes the operation and as you see makes a surprisingly good lower lip with very little deformity. The immediate result being excellent but the result within six weeks you will find will be much better. There will be quite complete muscular control and we have avoided any injury to the nerve supply of the flaps so that six or eight weeks from now there will be little deformity and very little loss of function of the mouth and lower lip. Taken altogether this is the most satisfactory plastic that we can make for a cancer of the lower lip.

There are several facts that I would like to bring out clearly in regard to this operation. First I believe that the most important thing that can be done with cancer of the lower lip is a very wide excision of the primary lesion and that that gives the patient the best prospect of a cure. In the second place my experience has led me to believe that when the lymphatic glands at the floor of the mouth are involved there is little prospect of a permanent cure even though we make a wide excision and

prospect that any operation can permanently cure the patient. Any operation therefore that is planned when the cancer has already invaded the regional lymphatic glands should be so planned that the surgeon should remove in one block of tissue the primary lesion and the lymphatics involved and an intermediate block of tissue between the primary lesion and the enlarged lymphatics because in this intervening block of tissue will be found a fine growth of cancer cells along the lymphatic vessels. If we leave this intervening block of tissue the patient may be benefited temporarily by the operation but the carcinoma cells still remaining will continue to grow and kill the patient ultimately of carcinoma. Let me illustrate this point by applying these facts to cancer of the tongue with a palpable definite involvement of the lymphatic glands at the floor of the mouth. If in such a case we remove the cancer of the tongue widely and thoroughly and then at a later operation dissect out the lymphatic glands in the floor of the mouth you may be sure that this will simply be a palliative operation because we would in such an event leave a block of tissue containing lymphatic vessels along which the cancer had grown from the tongue to the lymphatic glands at the floor of the mouth. A few years ago surgeons overemphasized the importance in cancer work of removing the lymphatic glands into which the cancer bearing area drained. This was carried to an absurdity especially in connection with radical operations about the uterus where we were taught for a short time that taking out the lymphatic glands along the iliac vessels was a matter of great importance in securing a permanent cure in carcinoma of the uterus. Of course in cancer of the breast where we can easily remove in one block of tissue the mammary gland and underlying pectoralis major muscle and axillary lymphatics and fat this should be done. I believe as a routine but even here we must remember that we should not place too much importance on the removal of the axillary lymphatic glands because these are but a part of the draining lymphatics of the mammary gland the mammary gland draining into the anterior mediastinum and into the posterior medias

make a radical extirpation of the glands and fat at the floor of the mouth. Our experience has been that where the regional glands are definitely and grossly involved the operation is almost always simply palliative. We do not accept the proposition that the glands at the floor of the mouth should be removed in all of these cases and our reason is this. If they are not already involved the safety of the patient depends upon a wide excision of the primary lesion. If they are involved an extensive dissection at the floor of the mouth simply gives an added palliation but not much if any prospect of a cure. I think it is well to keep in mind in operating on cases of carcinoma the way in which the cancer grows and invades tissues. Take a case like this patient. The cancer begins in the lower lip. It remains as a local lesion for a certain period of time and then it extends along the lymphatic vessels by a process of growth just as a vine grows along the ground and I frequently use the parallel of the growth of the pumpkin vine. The cancer cells do not float along the lymphatics. They grow along the lymphatics until they reach the nearest lymphatic gland. There they grow very rapidly so that within a short time there is a tangible enlargement of the involved lymphatic glands. The process then continues from these first lymphatic glands along the lymphatic vessels to the next group of lymphatic glands and eventually of course at some point the carcinoma undergoes degeneration softens and breaks into a blood vessel and then the carcinoma cells find their way into the blood stream and are carried to distant parts of the body deposited and produce general metastatic growths.

The hope of a cure of cancer anywhere in the body is that the patient can receive the benefit of a radical operation at a time when the cancer is still limited to the primary lesion and before it has involved the lymphatics. When the cancer is still limited to the primary lesion and the lesion is so situated that anatomically it can be widely removed the prospects of curing the patient of cancer are excellent. When however the lymphatics are already involved and especially when the nearest lymphatic glands are palpably enlarged there is little

worm gut stitches about the fifth or sixth day and about every other one of the interrupted silk stitches, and leave the balance until the ninth or tenth day

After-history —The patient made an excellent recovery. He had been in the habit of wearing a mustache and a beard, which he let grow, so that three months after operation there was no visible scar and little or any evidence of either the cancer or the result of the operation

tinal glands. These, of course, are beyond the reach of the surgeon's knife

I am inclined to give this patient the benefit of a short course of x ray treatment, let us say, eighteen to twenty exposures during the next two or three months, given by an expert of course, without subjecting him to the risk of burns. I think the prognosis in this case is fairly good probably about 50 per cent. of chance of a permanent cure. It is too bad, of course that the patient did not have this operation done months ago, because in early epithelioma of the lower lip the prospects of cure by radical excision are excellent and probably will be as high as 80 per cent. or more

In regard to handling these cases without radical operation and with the use of x ray alone, I would like to say a word. I have seen many superficial epitheliomas cured by the x-ray, but I do not regard epithelioma of the lower lip as a condition in which the x ray should be used alone, and even in small epitheliomas of the lower lip I believe the safety of the patient and the interests of the patient are best subserved by doing a radical excision and then using the x ray as a means of after treatment.

You will notice that we have not applied any dressing in the way of gauze or dressing of any kind in this case. I simply touch the line of incision with a small cotton applicator soaked in tincture of iodine. We shall have the man use the same mouth wash several times a day that we used in cleaning out his mouth before operation. We shall instruct him to keep his hands from it and every day or two to touch the line of incision with a little tincture of iodine. If there is any slight oozing from the incision we shall have the nurse instruct the patient to sponge it with a piece of sterile gauze simply to absorb the moisture. These cases are very much better without any dressing and simply exposed to the air

Although this operation has looked very formidable we shall have the patient sitting up this afternoon and he will sit up every day he feels inclined to do so. Of course we shall be compelled to feed him on a soft diet. We shall remove the silk

CLINIC OF DR. A. J. OCHSNER

AUGUSTANA HOSPITAL

THREE CASES ILLUSTRATING CERTAIN BENIGN LESIONS OF THE PAROTID GLAND

Summary Case I—Salivary calculus treatment by excision of parotid gland inflammatory changes about site of calculus rendering simple removal of calculus inadvisable dangers of the operation choice of incision how to avoid the facial nerve

Case II—Gunshot wound in parotid region repair of defect following evulsion of parotid gland and portion of lower jaw transplantation of fat and fascia

Case III—Tuberculosis of the parotid gland treatment importance of clean thorough dissection prime necessity of removing infected tonsils and adenoids dressings the use of antiseptics

CASE I—This patient is a doctor aged forty nine His family and past histories are negative

Twelve years ago he noticed that once in a while his right parotid gland became slightly enlarged and painful, at the same time he noticed that saliva from that gland did not empty freely into the mouth He could feel with his finger a little hard body located in the middle portion of the gland it disappeared when a small stone came out into the mouth This stone was about 3 mm in length In May 1918 the gland became very much enlarged and painful and the secretion stopped completely The patient was operated and the gland was found full of saliva Steno's duct was opened and a little stone removed Following operation he had an infection with abscess formation the pus discharging through the wound At present the saliva does not flow into the mouth The wound is fistulated, saliva and some pus coming out through it The gland is enlarged and at times painful

His appetite is good, habits negative

together with the removal of the stone which is impacted in the upper portion of the duct would not give him permanent relief and would therefore be useless. The lack of drainage through Steno's duct has resulted in so many infections and so much irritation that the patient fears the development of a malignant growth.

It seems consequently wise to remove the entire gland together with the stone which is impacted about its center. The dangers of the operation are confined to injury of the branches of the facial nerve whose course is indicated in Fig 319. The close proximity of the nerve and artery makes it difficult to clamp and ligate the latter without traumatizing the nerve.

In order to accomplish the removal with the slightest likelihood of injury to the nerves it is wise to expose the entire outer surface of the gland by reflecting a flap of skin as indicated in Fig 320 1. Another incision can be substituted for this as indicated in Fig 321 1. The greater portion of this incision is in the line of the angle of the jaw so that it does not disfigure the patient to any marked extent but it is difficult to expose the gland in a satisfactory manner through this incision and consequently we will choose the incision illustrated in Fig 320 1 which permits one to make an absolutely complete exposition of the entire gland and the vessels and nerves.

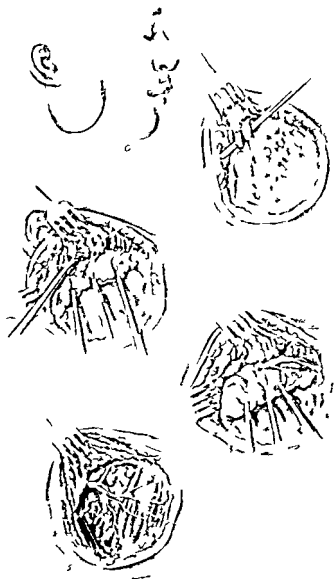
The flap is turned back as indicated in Fig 320 2 exposing the facial nerve together with the blood vessels and exposing the artery and vein and branches of the facial nerve which extend in a fan shaped direction underneath the gland. This illustrates how difficult it would be to control hemorrhage without injuring the nerve in case one failed to take the precaution of carefully isolating the blood vessels and clamping and ligating these before attempting to remove the gland itself. During the subsequent steps of the operation it is wise to leave the angle of the mouth exposed and to lightly pinch the tissues with a dissecting forceps before cutting them because if the tissue about to be severed contains a branch of the facial nerve it will be possible to see the contraction of the muscles at the angle of the mouth and in case of these contractions the nerve must be

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In order to accomplish the removal with the slightest likelihood of injury to the nerves it is wise to expose the entire outer surface of the gland by reflecting a flap of skin as indicated in Fig. 320-1. Another incision can be substituted for this as indicated in Fig. 321-1. The greater portion of this incision is in the line of the angle of the jaw so that it does not disfigure the patient to any marked extent but it is difficult to expose the gland in a satisfactory manner through this incision and consequently we will choose the incision illustrated in Fig. 320-1 which permits one to make an absolutely complete exposition of the entire gland and the vessels and nerves.

The flap is turned back as indicated in Fig. 320-2 exposing the facial nerve together with the blood vessels and exposing the artery and vein and branches of the facial nerve which extend in a fan shaped direction underneath the gland. This illustrates how difficult it would be to control hemorrhage without injuring the nerve in case one failed to take the precaution of carefully isolating the blood vessels and clamping and ligating these before attempting to remove the gland itself. During the subsequent steps of the operation it is wise to leave the angle of the mouth exposed and to lightly pinch the tissues with a dissecting forceps before cutting them because if the tissue about to be severed contains a branch of the facial nerve it will be possible to see the contraction of the muscles at the angle of the mouth and in case of these contractions the nerve must be



dissected out of the tissues to be cut in order to prevent paralysis of the muscles supplied by the respective nerves. The vessels and nerves have now been laid bare directly in front and a little below the ear and have been separated so that a forceps can be applied to the vessels without danger of injuring the nerve (Fig 320 3). The vessels are cut between forceps and ligated at once in order to remove the forceps from the field of operation and then the dissection of the gland is carried on step by step from behind forward being careful at each side to preserve all the nerves. Some of the smaller branches will undoubtedly be cut but by preserving the larger branches the nerve supply of the face will remain almost normal so that the deformity will be exceedingly slight except when the patient tries to pucker his lips as in attempting to whistle.

Before proceeding with the removal of the gland we will open Steno's duct directly over the enlargement about its center making an incision into the gland in the direction of Steno's duct which corresponds to the direction of the nerves so that the incision is parallel with the lower jaw as shown in Fig 320 4. This exposes a calculus nearly 2 cm in length and $\frac{1}{2}$ cm in diameter. It is surrounded by a quantity of thin pus contained in a cyst like cavity the fluid evidently consisting of the infected secretion of the parotid gland. With a fine probe we will try to locate the efferent duct whose function it was to carry this secretion of the gland into the mouth but it would be quite surprising if we should succeed in finding the lumen of this duct because it has been occluded for months.

Having failed to find this lumen we proceed to the excision of the gland avoiding all the nerve branches which can be seen and as many as possible of the minute branches by first pinching the tissues before cutting them. This leaves a cavity

Fig 320 —1 Enlarged parotid gland showing scar of old incision and a small fistulous opening. Note line of incision. 2 The skin and subcutaneous tissue flap has been dissected upward exposing to view the temporal artery and vein and the body of the parotid gland. 3 The gland being separated from the masseter muscle after ligation of the temporal vessels. 4 Steno's duct exposed showing the calculus. 5 A view of base of wound after total removal of the parotid gland showing branches of the facial nerve.

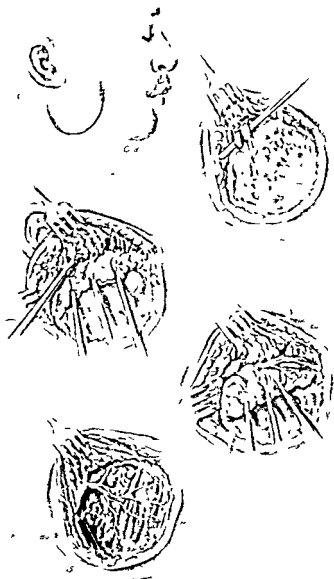


Fig 320

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Fig 320—1 Enlarged parotid gland showing scar of old incision and very small fistulous opening. Note line of incision. 2 The skin and subcutaneous tissue removed. 3 The gland being removed showing temporal vessels. 4 Steno's duct exposed showing the calculus. 5 View of base of wound after total removal of the parotid gland showing branches of the facial nerve.

overlying the masseter muscle and the joint of the inferior maxilla free from gland tissue, but still containing the branches of the facial nerve which have been preserved (Fig. 370.5)



Fig. 371-1 Depressed scar over region of angle of right mandible. Note line of incision. The flap has been reflected upward and a portion of fascia lata placed in the depression fat side outward and sutured to the edges of the wound. The total width of the transplant is shown by a dotted line.

The skin flap is now placed in position and sutured with the greatest care with horsehair. Only a very small bite is taken on each side and the suture is drawn just sufficiently tight to bring the edges together care being taken not to produce any stitch marks by tying the sutures tightly. A minute drainage

serted at the lowest angle to prevent the accumulation of serum. This will be removed in twenty four hours and will permit the edges to come together accurately at this point early. In this manner we can effectually avoid a troublesome scar. Of course, the fact that the cyst containing the stone was infected will make it possible for some infection to take place underneath this flap, although we were exceedingly careful in trying to prevent any of the fluid from touching the wound. As a result of this operation the patient undoubtedly will be free from a recurrence of his trouble. The deformity from the scar will be minimum and there will be practically no deformity from paralysis due to section of the nerves passing through and behind the parotid gland.

CASE II —The second patient is a male aged thirty one. Five years ago he received a gunshot wound, the bullet entering the left cheek 2 cm. behind the angle of the mouth. The point of exit of the bullet was 2 cm. in front of and below the right ear. The angle of the right inferior maxilla was torn to pieces. The wound discharged for one month, some sequestra coming out, and then it healed up spontaneously. He has had no pain and the injured region is not painful on pressure. He is able to masticate well. His general health is good.

This case is almost the exact opposite of the patient upon whom we have just operated. At the point at which the former had an enlargement this patient has a marked depression due to the absence of his entire parotid gland together with the angle of the jaw, including the articular portion. The bullet which entered his left cheek passed out through the region of his right parotid gland and carried with it the entire angle of the jaw and the entire parotid gland, leaving a marked deformity because of the depression due to the absence of these structures. He has retained a sufficient amount of the masseter muscle and also the entire lower jaw in front of the angle, together with the teeth contained in the remaining portion of the jaw, so that he has little difficulty in masticating his food.

The articular portion of the jaw being absent, it would be

quite useless to insert a bone-graft as this would undoubtedly fail to improve the function of his lower jaw although it might possibly be improved cosmetically. The object to be accomplished then must consist in removing the deformity and the question of the method to be employed lies between the grafting of a piece of bone taken from the tibia or from one of the ribs, the grafting of fat and fascia, or the introduction of paraffin. The use of bone is hardly indicated because it is more difficult to accomplish a satisfactory result where it does not touch the jaw bone at each end than the introduction of other tissues and it would be difficult to make a smooth correction of the deformity with bone. The use of paraffin is not very satisfactory because of the fact that the region is not at rest and the paraffin would be likely to cause more or less irritation. The introduction of fat and fascia, on the other hand seems to be the most satisfactory because we can arrange the size of the graft in accordance with the necessity, and arrange its form so that the cavity will be filled to a slightly greater extent than is necessary to overcome the deformity because there will be later a slight amount of loss of tissue and by overcorrecting the deformity at the time of operation one can produce almost a perfect correction.

In this case the incision to be chosen is shown in Fig 321 1 because here it is not necessary to make an accurate dissection. All that is required is an exposure of a sufficient amount of space to enable us to fill in enough tissue to correct the deformity. We consequently cut a flap a little larger than the extent of the depression and fold it back. We next search for a portion of the body in which there is an abundance of fat and dissect out a flap about one-fourth larger than the flap in the patient's cheek in order to provide for shrinkage of the flap to be excised. We dissect up the flap slightly larger and thicker than would be sufficient to fill in the depressed area and of as nearly the same form as we can and transfer this immediately to the space laid bare by the incision. The flap is then carefully sutured with very fine chromicized catgut suture into the depressed space and a sufficient number of interrupted sutures are used

to hold it securely in place as shown in Fig 321 2 Then the skin flap is carried over and the transplanted flap of fat and fascia sutured in place with the same care and accuracy as was practised in the previous case There is no likelihood of infection in this case because the greatest possible precaution has been taken in every step of the operation Consequently it will not be necessary to provide for drainage although it happens occasionally that some of the fat in the transplanted flap will be liquefied before it has grown into its new place and this liquefied fat will seek the lowest portion of the cavity and will have to be evacuated by the separation of one of the stitches

Now that the operation has been completed we have a slight enlargement directly over the area that was occupied by the depression but this we believe is only sufficient to provide for the natural shrinkage which always occurs after correcting such deformities

CASE III—The third patient is a man of twenty seven years who complains of a swelling of the left side of the neck of eight months duration

Examination—The left parotid gland is the site of an irregular hard tumor mass occupying the posterior portion of the gland anterior to the ear and roughly the size of a small egg The posterior chain of cervical lymph glands on the left side is enlarged discrete not tender and freely movable as a continuous chain as far down as the level of the clavicle The largest gland measures 2 x 3 cm in its opposite dimensions

This patient comes with a swelling in the region of the parotid gland about 2 cm in thickness and covering the entire lower half of the gland There is secondary swelling along the anterior edge of the sternocleidomastoid muscle There is a history of tonsillar infection and a secondary infection of the middle ear There is no fluctuation perceptible over any of the swellings The development of the swelling has been so slow that it seems likely that we have to deal with a tuberculous process involving the lower portion of the parotid gland and the cervical lymph nodes

quite useless to insert a bone-graft as this would undoubtedly fail to improve the function of his lower jaw although it might possibly be improved cosmetically. The object to be accomplished then must consist in removing the deformity and the question of the method to be employed lies between the grafting of a piece of bone taken from the tibia or from one of the ribs the grafting of fat and fascia or the introduction of paraffin. The use of bone is hardly indicated because it is more difficult to accomplish a satisfactory result where it does not touch the jaw bone at each end than the introduction of other tissues, and it would be difficult to make a smooth correction of the deformity with bone. The use of paraffin is not very satisfactory because of the fact that the region is not at rest and the paraffin would be likely to cause more or less irritation. The introduction of fat and fascia on the other hand seems to be the most satisfactory because we can arrange the size of the graft in accordance with the necessity and arrange its form so that the cavity will be filled to a slightly greater extent than is necessary to overcome the deformity because there will be later a slight amount of loss of tissue and by overcorrecting the deformity at the time of operation one can produce almost a perfect correction.

In this case the incision to be chosen is shown in Fig 3²¹ 1 because here it is not necessary to make an accurate dissection. All that is required is an exposure of a sufficient amount of space to enable us to fill in enough tissue to correct the deformity. We consequently cut a flap a little larger than the extent of the depression and fold it back. We next search for a portion of the body in which there is an abundance of fat and dissect out a flap about one-fourth larger than the flap in the patient's cheek in order to provide for shrinkage of the flap to be excised. We dissect up the flap slightly larger and thicker than would be sufficient to fill in the depressed area and of as nearly the same form as we can and transfer this immediately to the space laid bare by the incision. The flap is then carefully sutured with very fine chromicized catgut suture into the depressed space and a sufficient number of interrupted sutures are used

nerve which usually cross some of the enlarged lymph nodes. It is important to dissect out one lymph node with special care which is almost always located at the bifurcation of the facial vein with the deep jugular vein (Fig 322 2). If possible the lymph nodes should not be crushed or opened in order not to disseminate any of the tuberculous material contained in them. Nearly thirty years ago Dr Christian Fenger pointed out the importance of making an absolutely clean dissection of the neck in these cases in order to remove not only the glands which were markedly infected but also the smaller glands which have but a slight amount of infection. At that time the results from these operations were not satisfactory because the two most important elements in the treatment had not been introduced namely the removal of the focus of infection in the tonsils or adenoids and the dietetic and hygienic after treatment. A large proportion of patients who were treated quite as thoroughly as we treat these patients at the present time died within a few years of pulmonary tuberculosis. They had been but slightly benefited by the removal of the infected glands. Later on it was found that a large proportion of these patients would recover fully and permanently if the tissues primarily infected namely the tonsils and adenoids were removed and the patient were placed under the best possible hygienic surroundings and given the best kind of nourishing food. Some cases received treatment of tuberculin injections or had the neck exposed to x ray treatments. In our experience a very large number of patients treated by this plan have recovered fully and permanently but this is the case only when the infection has not destroyed the tissues of the lymph nodes or the tissues of the parotid gland which is the case in the patient before us. However even if these glands have been destroyed to a greater or less extent these patients will frequently make a permanent recovery without removal of the glands if the infected glands are laid open curetted and treated with iodine or bismuth paste but the deformity resulting from this operation is much more objectionable than the deformity from the incision which we are

The treatment must consist in the removal of all these diseased tissues together with the removal of the infected tonsil. These tissues can be approached most effectually through an incision extending from the mastoid process along the anterior border of the sternocleidomastoid muscle (Fig. 522-1). In order



Fig. 522-1 Enlarged lower pole of parotid gland and several enlarged cervical lymph-glands. Note line 1 incision along anterior border of left sternocleidomastoid muscle. 2 Dissection showing the parotid and cervical glands enlarged. Note the large gland 3 at the junction of the facial with the jugular vein.

to secure a permanent result we must of course remove all these glands so that there will be none of the tuberculous material left to cause recurrence. On removing these glands it is important to avoid injuring the branch of the facial nerve which we preserved in the first one of these three cases. Lower down it is important to preserve the branches of the spinal accessory

nerve which usually cross some of the enlarged lymph nodes. It is important to dissect out one lymph node with special care which is almost always located at the bifurcation of the facial vein with the deep jugular vein (Fig. 322-2). If possible the lymph nodes should not be crushed or opened in order not to disseminate any of the tuberculous material contained in them. Nearly thirty years ago Dr. Christian Fenger pointed out the importance of making an absolutely clean dissection of the neck in these cases in order to remove not only the glands which were markedly infected but also the smaller glands which have but a slight amount of infection. At that time the results from these operations were not satisfactory because the two most important elements in the treatment had not been introduced namely the removal of the focus of infection in the tonsils or adenoids and the dietetic and hygienic after treatment. A large proportion of patients who were treated quite as thoroughly as we treat these patients at the present time died within a few years of pulmonary tuberculosis. They had been but slightly benefited by the removal of the infected glands. Later on it was found that a large proportion of these patients would recover fully and permanently if the tissues primarily infected namely the tonsils and adenoids were removed and the patient were placed under the best possible hygienic surroundings and given the best kind of nourishing food. Some cases received treatment of tuberculin injections or had the neck exposed to x-ray treatments. In our experience a very large number of patients treated by this plan have recovered fully and permanently but this is the case only when the infection has not destroyed the tissues of the lymph nodes or the tissues of the parotid gland which is the case in the patient before us. However even if these glands have been destroyed to a greater or less extent these patients will frequently make a permanent recovery without removal of the glands if the infected glands are laid open, curetted and treated with iodine or bismuth paste but the deformity resulting from this operation is much more objectionable than the deformity from the incision which we are

making because this is largely hidden by the line of the anterior edge of the sternocleidomastoid muscle

We have now exposed the infected portion of the parotid gland and the infected lymph nodes in their relation to the anatomic structures in the neck. We will carefully continue the dissection removing the entire lower half of the parotid gland which contains caseous material and all the enlarged lymph nodes. The upper ones have all undergone caseous degeneration. The lower ones which have been infected more recently do not show this change.

After removing all these structures we cover the entire surface with a per cent compound tincture of iodine because we have a superstition in favor of this remedy. Others use iodoform and still others no antiseptic whatever and the results seem to be equally good but having had most satisfactory results in cases in which we have applied tincture of iodine we continue to use this remedy and feel justified because it seems perfectly proper to make use of any method of which we are certain that it is entirely harmless even though it may be practically useless at the same time. Were there any doubt concerning the former quality of the remedy in these cases we should of course follow the practice of those that use no antiseptic whatever after removal of these glands. The use of iodoform is probably equally harmless but it is extremely objectionable because of its disagreeable odor.

In closing the wound whenever the infected glands have not been opened or there has been no soiling we close the entire wound. Whenever there has been soiling we pack a piece of gauze lightly into the wound and permit it to protrude through a little buttonhole behind the lower edge of the wound. This gauze is removed on the second day after operation. The wound is then closed by applying some particularly fine catgut sutures about 2 inches apart throughout the line of incision in order that the tension may be taken off entirely from the skin sutures which are applied in the manner practised in the first and second cases.

CLINIC OF DR. DANIEL N. EISENDRATH

COOK COUNTY AND MICHAEL REESE HOSPITALS¹

METHODS OF EXAMINATION IN THE DIAGNOSIS OF ABDOMINAL TUMORS

Summary A general review of the information to be gained by physical examination in the presence of abdominal tumors importance of the clinical history inspection points to be noted palpation importance of percussion in the examination of hollow viscera auscultation special methods

I DESIRE to present during the present course cases illustrating many varieties of abdominal tumors employing the latter term in its broader sense of a swelling, no matter what its origin may be because it is very difficult at times to exclude the possibility of an inflammatory origin in a given swelling. One of the patients whom I will show had a primary carcinoma of the cecum, complicated by abscess formation which led some of us before operation to feel certain on account of the rise in temperature, apparently acute onset, and high blood count that we were dealing with a purely inflammatory tumor having its origin in the appendix, while in the opinion of others a neoplasm alone was present. I need hardly recall in this connection the observation which no doubt is familiar to you, namely, that it is almost impossible in certain cases, without a microscopic examination, to differentiate the hyperplastic form of tuberculosis of the cecum from a carcinoma. It is of interest in this connection to note that W. J. Mayo found carcinoma was present in 31 per cent. of the cases of diverticulitis of the sigmoid. In order to

¹The cases cited in this series of clinics on abdominal tumors were presented in clinics at both the Cook County and the Michael Reese Hospitals. Only the diagnosis in general is taken up in the present clinic; the special diagnosis of the tumors of individual structures being reserved for future clinics.

justify my retention of the term 'tumor' let me direct your attention to the fact that tertiary syphilis of the various abdominal viscera especially of the stomach will greatly simulate a malignant condition. Again how often do we find that the torsion of a tumor with a long pedicle such as an ovarian cyst, gives rise to purely inflammatory symptoms the underlying cause being discovered only at operation.

I could cite numerous analogous examples of the puzzling clinical pictures which one encounters in this field but will reserve a more detailed reference until I present some typical cases of each class in future clinics. Let me impress upon you at this time however the necessity of most thorough investigation of every patient who has an abdominal tumor (in the sense I have employed the term) if you would avoid the many pitfalls which lie in the path of those who do not employ every modern diagnostic aid in their daily work.

The data upon which we base our diagnosis of an abdominal tumor are the following

- 1 A careful clinical history
- 2 The physical examination
- 3 Special methods of diagnosis

The special methods of diagnosis such as radiography pyelography ureteral catheterism gastric analysis blood examination etc. have not only greatly simplified our problem but have enabled the surgeon to make a diagnosis at a much earlier period than was formerly the case.

To depend upon a physical examination alone without calling to our aid these newer methods of diagnosis is a step backward. Therefore it is of the utmost importance to be familiar with these methods. The surgeon who gives his patient the benefit of every possible resource at his disposal will by a skilful combination of the various data make a diagnosis in the majority of cases.

1 Value of Accurate Clinical History—The value of the history of the mode of development of an abdominal tumor can not be too strongly emphasized. The age of the individual his family and venereal history the possible relation of any

previous illnesses to the present one, the history of an accident or of previous operations, whether he has lived in a tropical country, and a gain or loss in weight are of the first importance. In some cases there are definite symptoms pointing to some lesion of the alimentary canal such as colicky pain, vomiting, constipation, abdominal distention or bloody vomitus, or stools. At times there is a history of persistent or recurrent hematuria or pyuria accompanied by bladder symptoms to aid one in suspecting some lesion of the urinary tract. The sudden or gradual onset of jaundice with or without acholic stools is of great value in localizing the seat of a tumor. At times you will obtain the history of having noticed a circumscribed or a more generalized enlargement of the abdomen accompanied by symptoms pointing to a definite structure. It must not be forgotten that more than one tumor may be found and again that an abdominal tumor is often only a metastasis of a malignant condition in some other portion of the body and vice versa (see Fig 328, *D*). A metastatic tumor which has first attracted our attention may be extra-abdominal and yet the primary seat be in one of the abdominal viscera. This last named condition is not infrequently found in cases of certain tumors of the kidney like hypernephroma, where the bony metastases (see Fig 328, *D*) overshadow in the clinical picture the primary enlargement. A pneumococcus or tuberculous peritonitis may form an encapsulated collection of fluid (see Fig 329, *F*) and the diagnosis be exceptionally difficult unless one has obtained a history of an acute onset. Actinomycosis or tuberculosis of the cecum may give rise to a tumor in the right iliac region of such form and consistency as to render the differentiation from carcinoma almost impossible unless microscopic examination is made. In the case of tumors arising from the pelvis it is very important to consider not only the age of the patient but also all deviations from the normal menstrual history, and finally a history must also include the possibility of

being pre
sarcoma is

more frequently present in young persons. In the case of tumors

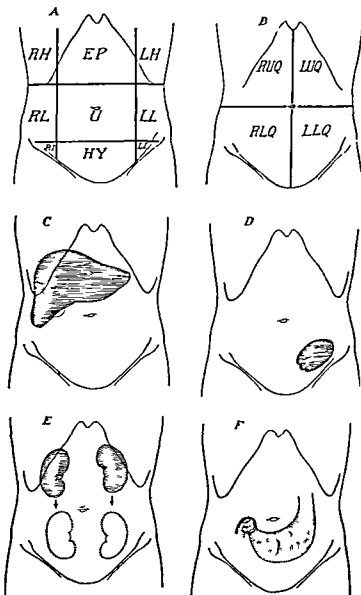


Fig 323

with long pedicles it is of importance to obtain a history as to any possible change in position which has been noted by the patient, or any symptoms accompanying such a change in position.

In attempting to make a diagnosis of an abdominal tumor you must not omit a thorough general examination. For example a splenic tumor may be simply a local expression of leukemia or an enlarged liver can be the seat of multiple metastases following a carcinoma of the breast operated years before.

The history of a sudden appearance and disappearance of tumors is of importance. This is found in the so called hysteric tumors in tumors due to impaction of feces, and in some cases of pancreatic and ovarian cysts.

I could mention innumerable combinations of symptoms which one encounters in daily practice, but as I stated before, the diagnosis of an abdominal tumor is made by a careful analysis of the data obtained by many methods an important factor being a careful clinical history.

2 Physical Examination of the Abdomen—1 *Inspection*

(a) *Location of Tumor*—There are two principal methods of dividing the abdomen for purposes of physical examination in order to describe the location of a tumor. In one of these (Fig 323-1) we choose certain more or less fixed anatomic points and divide the surface into nine regions with which every student

Fig 323-1 Divisions of abdomen into its nine regions. *RH* and *LH* Right and left hypochondriac regions. *RL* and *LL* Right and left iliac regions. *EP* Epigastric region. *U* Umbilical region. *HY* Hypogastric region.

B Division of abdomen into quadrants. *RUQ* and *LUQ* Right and left upper quadrants. *RLQ* and *LLQ* Right and left lower quadrants.

C Location of liver in hepatoptosis. Lower border often at level of umbilicus so enlargements of gall bladder or tumors on anterior surface or inferior border may be found in right iliac region.

D Movable spleen lying in left iliac fossa. Note the characteristic notches along anterior edge of spleen.

E Abnormal mobility of the kidneys. Note difference in position of normally located and of movable kidneys (dotted outline).

F Carcinoma of pyloric end of stomach in a case of low position of the viscus (gastroptosis). Note position of greater curvature below transverse line through anterior superior spines. tumor palpable below level of and to right of umbilicus.

of anatomy is familiar. In the second method the umbilicus is chosen as the fixed point, the resulting division (Fig. 323, *B*) being into quadrants. The latter method is being employed more and more every year, and yet the nine region division has been so thoroughly drilled into us in our early medical school years that

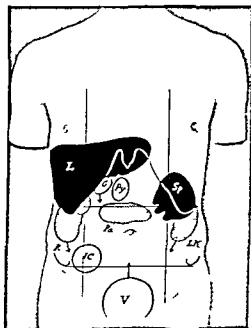


Fig. 324—Tumors of the abdominal viscera. The black arrows indicate the directions in which they grow. *L* Liver *G* gall bladder *Py* pylorus *Pa* pancreas *R* right kidney *LK* left kidney *Sp* spleen *IC* ileocecal tumors *V* tumors due to distended bladder ovarian cysts growing upward fibroids of uterus etc. (Eisendrath Surgical Diagnosis.)

it is difficult to abandon it for the more simple division into quadrants. Whether the one method or the other is used it is necessary to be familiar at least with the viscera which normally lie beneath the surface of the various regions. A glance at Fig. 324 will recall the usual locations of these viscera and show

why tumors arising from them are most frequently found at the place where the viscus normally lies. It would greatly simplify matters however if we were certain that a given viscus could always be found in its normal location. Unfortunately this is not the case hence you must be familiar with the fact that there are all possible variations from the normal position of the abdominal viscera. This deviation is due to a number of causes such as (a) elongation of structures which act as supports thus permitting of a wide range of mobility (b) congenital anomalies so that the viscus develops at an abnormal location or there is a complete transposition of both thoracic and abdominal viscera. Examples of the first group in which an elongated support permits a viscus to be found in an abnormal location is not infrequently observed clinically in the case of solid viscera like the liver (Fig 323 C) the spleen (Fig 323 D) and the kidneys (Fig 323 E) as well as in the hollow viscera such as the stomach (Fig 323 F) and the various portions of the large bowel (Fig 325 1 B C). As examples of the second group in which the abnormal location is the result of a congenital anomaly I might mention the dystopic kidney the viscus being located either in one of the iliac fossa or even in the true (bony) pelvis (Fig 325 D). Other instances of malposition as the result of developmental disturbances are the presence of an undescended testis within the abdomen (abdominal form of non descent) or a faulty rotation of the cecum so that it lies just beneath the liver. One of the most interesting and fortunately for the diagnostician rather rare conditions is a complete transposition of both thoracic and abdominal viscera those which normally lie upon the right half of the abdomen being found in the left half and vice versa (Fig 325 E). You must never forget that an enormously distended urinary bladder may cause a median enlargement just above the pubes (Fig 325 I). At first sight it would seem superfluous to mention this but I was once called in consultation to see a case of suspected encapsulated peritonitis in which the introduction of a catheter soon showed that the attending physician had not thought of such a simple condition as a distended bladder.

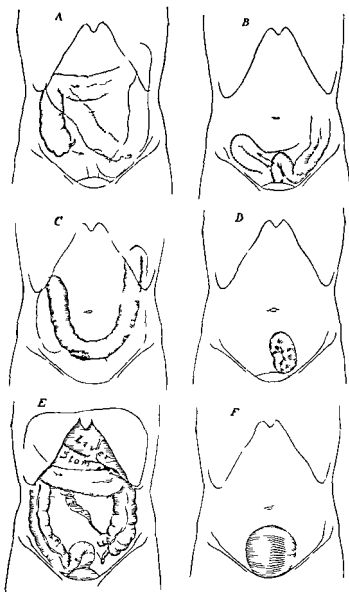


Fig. 325

(b) *Changes in Contour of the Abdomen Either General or Localized*—A collection of fluid within the abdomen can, as you know either be generalized or encapsulated. In the former case there is a general widening of the abdomen especially in the flanks and the lower portion of the abdomen. This condition is called ascites, of whatever origin it may be. In the case of encapsulated fluid there is only a localized change in contour. Ovarian cysts and uterine tumors in fact any tumor arising from the true pelvis, cause enlargement lateral or median, in the lower portion of the abdomen. Tumors of the spleen and kidney give rise to a prominence in the corresponding lateral regions. Tumors of the stomach mesenteric glands, omentum, or pancreatic cysts cause a central enlargement. The lateral bulging or prominence is not infrequently due to an aneurysm of the abdominal aorta or a very vascular sarcoma arising from the retroperitoneal tissues. You will understand the reason for these various changes in contour of the abdomen by a study of Figs 328, *A* to 329 *D* inclusive.

(c) *Inspection of the Color of the Skin etc*—One of the first things to note is whether there is any change in the color of the patient's skin. The presence of jaundice accompanied by certain abdominal findings is of great aid in the recognition of tumors of the head of the pancreas (Figs 326, 329 *E*, and 330) or of an enlarged liver (Fig 329 *E*) or of some form of obstruction.

Fig 325 — 1 Abnormal mobility of the cecum. The cecum in these cases may be close to or even beyond (to left of) the median line or next to the bladder in the true (bony) pelvis.

B Abnormal mobility of the sigmoid. If the mesosigmoid is very long the sigmoid is found to right of the median line.

C Tumor (carcinoma) in an unusually long and movable transverse colon. Radiography has shown that this portion of the colon lies even under normal conditions much lower than formerly thought.

D Position of kidney in a case of congenital dystopia. Note location of the kidney in the true (bony) pelvis. The renal pelvis and ureter is usually directed forward.

E Transposition of viscera. Note position of liver in left upper quadrant and of cecum in left lower quadrant.

F Prominence in median line in suprapubic region due to greatly distended bladder.

of the common duct of a non malignant nature such as calculus or stricture

In pection of the abdomen as to the presence or absence of dilatation of the superficial veins is of importance. If the veins in the central portion of the abdomen are dilated it points to some obstruction in the circulation whereas if the veins on the lateral aspects of the abdomen or thigh are dilated (Fig 371)

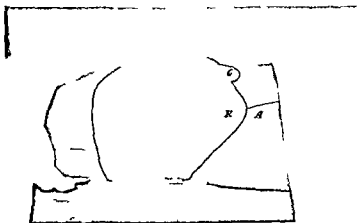


Fig 36 Side view of case of carcinoma of the head of the pancreas Eisenendrath Surgical Diagnosis Yellow tint of flesh due to obstruction of common duct as it passes through head of pancreas to reach the duodenum C Enormously distended gall bladder which could be distinctly felt through the abdominal wall. Its contents were clear on account of the long standing obstruction of the common duct R Lower border of right lobe of liver which enormously enlarged on account of secondary deposits. The upper level of liver dullness is shown just below the level of the nipple A Area of dullness due to free fluid in peritoneal cavity due to pressure upon portal vein

there is some obstruction to the return circulation in the vena cava

Inspection must also include the presence or absence of the testis as there is always a possibility of a pelvic tumor arising from a retained abdominal testis.

(d) *Visible Peristalsis or Pulsation*—Never omit a glance at the abdomen to see whether peristaltic waves are present as

this is of great importance in the diagnosis of certain tumors like those of the pylorus with a corresponding obstruction of the intestinal lumen. Again certain tumors either aneurysms or very vascular enlargements show visible pulsation which is of importance in making up the data upon which a diagnosis is based. You must not forget however that a tumor which lies in close relation to some of the large blood vessels of the abdomen may show transmitted pulsation. Expansile pulsation speaks for an aneurysm, lifting pulsation for a tumor attached to or

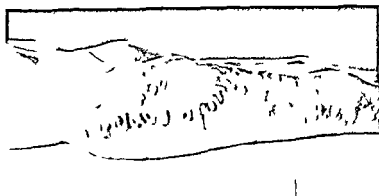


Fig. 32 Lateral view of tumor of abdomen due to aneurysm of the external iliac artery causing prominence in right iliac region. (E. S. Enders, *Surgical Diagnosis*.) Note the extensive varicose veins along the outer aspect of the thigh.

in close relation to a blood vessel but a very vascular sarcoma may cause a pulsation simulating greatly that of an aneurysm.

2 Abdominal Palpation—Palpation helps in the differentiation of tumors of the abdominal wall from those within the abdomen. In the latter the tumor becomes less prominent when the patient is asked to sit up whereas in the former it becomes more prominent. Certain methods of palpation are considered more or less standard. The best position for the patient is the dorsal one with the shoulders slightly raised and the thighs flexed (Fig. 331). You must never neglect to have warm hands and to lay them flat upon the abdomen making

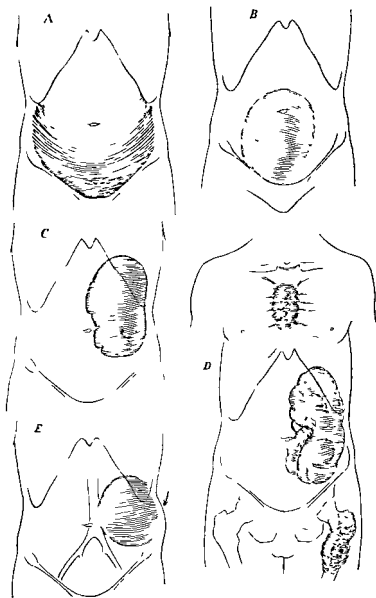


Fig. 328

pressure gradually. For tumors which lie beneath the costal arch the hand is inserted deeper and deeper with each inspiration. For renal tumors bimanual palpation (Fig. 332) is a most excellent method. The value of rectal and bimanual vaginal examination cannot be too strongly urged. In some cases it will be impossible to palpate the abdomen until some of the free fluid has been removed by tapping.

Mobility—Tumors may be immovable *i. e.*, fixed. This is the case when they are adherent to the bones such as the spine, pelvis or ribs, or to the retroperitoneal tissues. A tumor may, on the other hand, possess either passive or respiratory mobility. The latter is usually present in tumors of the stomach, transverse colon, liver, gall bladder, and kidneys, that is, in all upper abdominal tumors unless they are fixed by adhesions. Inflammatory tumors have little if any mobility, either passive or respiratory, no matter what organ or structure they arise from or are in proximity to. Tumors of the abdominal wall do not show any respiratory or passive mobility. At times it is possible to determine the origin of a tumor, for example, a greatly distended gall bladder, by its relation to an organ which possesses respiratory mobility (Fig. 330).

Passive Mobility—Tumors of a normally placed spleen or kidney have but slight passive mobility, whereas those of a movable spleen or kidney may have a very extensive range of mobility. Retroperitoneal tumors (Fig. 335, *B*) and encapsulated intraperitoneal exudates have but little passive mobility. At

Fig. 328—*A* Areas of prominence and of dulness in ascites. Note dulness in flanks and above pubes and tympany in center of abdomen (compare with Fig. 328, *B*).

R A m e f — — —

C Left quadrant emerges from beneath left costal arch and has a characteristic notched anterior edge.

D Primary renal tumor (hypernephroma) with bony metastases in the sternum and femur. The metastases in this variety of kidney tumor may appear before the primary growth is recognized.

E Bulging on left side of the abdomen due to large aneurysm of the abdominal aorta.

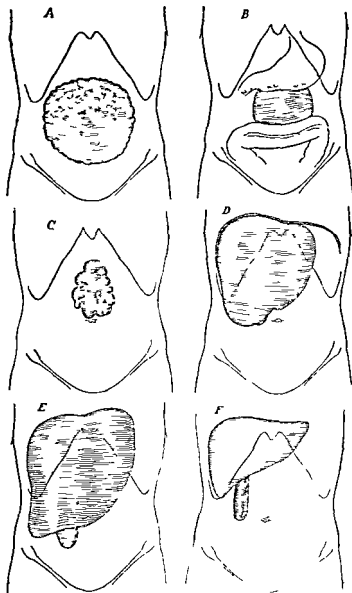


Fig 329

times, however, we find cases in which the range of mobility is very extensive. This is true of tumors developing in a movable cecum, transverse colon, or sigmoid (Figs 325, *A*, *B*, *C*, and 334, *B*). Tumors of the pylorus in certain cases have a wide range of mobility (Fig 334 *A*). The same is true of tumors of the uterus (fibroids) or ovarian cysts with long pedicles (Fig 334, *C*) or of mesenteric cysts (Fig 334, *D*). One is often able to determine that a tumor arises from a certain organ by noting the center of the circle formed by the range of mobility of the tumor.

Other Data Obtained by Palpation—The presence or absence of fluctuation can be determined by palpation aided by percussion for waves of fluid. The consistency, size, nature of the surface of the tumor and of its edges and the presence or absence of genuine or transmitted pulsation are all of importance in making a diagnosis. Not infrequently tumors of the spleen retain characteristic notches (Fig 328, *C*) of the normal spleen until they have attained such a size that it is impossible to recognize the origin of the tumor.

3 *Percussion* is of less importance than palpation except in showing us the relation of a hollow viscus to the tumor and whether free fluid is present or not (Fig 328 *A*). In free fluid, dulness is always present in the flanks and above the pubes, and changes its location somewhat when the patient is turned on his side. This is not true of encapsulated fluids which remain constant in position and area of dulness (Fig 329, *F*). Percussion is of value, especially when aided by inflation of the colon,

Fig 329—*A* Prominence in central portion of abdomen due to large tumor (sarcoma) of the omentum

B Location of pancreatic cysts. Most frequent variety presents between transverse colon and stomach

C Tumor mass in epigastric region due to tuberculous glands at root of mesentery (author's case)

D Area in right upper quadrant of abdomen in which enlargements of liver are usually found

E Enormous enlargement of liver and greatly distended gall bladder in cancer of head of pancreas (compare with Figs 326 and 329 *F*)

F Elongated sausage shaped tumor in right upper quadrant due to hydrops of gall bladder

in determining the relation of a retroperitoneal tumor to the bowel. This method of inflation of the colon is of less value today since the introduction of colonoscopy than it was in former years, but not infrequently it is of great value if an x-ray examination cannot be made, to inflate the colon and note by percussion that the tumor (Figs 334, C and 334, E) lies behind the



Fig 330—Topographic relations of tumor (cancer) of head of pancreas. The tumor causes jaundice (see Fig 326) and enlargement of the liver and gall bladder (see Fig 329, E) by pressure on the common bile-duct. The ascites in these cases is due to pressure upon the portal vein.

inflated colon. The only fallacy exists when there are adhesions of the colon to the tumor, so that the colon is displaced inward (Fig 334, F) instead of lying in front of the tumor. The presence or absence especially of free fluid can frequently be noted by tapping on one side of the abdomen while the outstretched hand is held at a point directly opposite, thus eliciting and detecting a wave when fluid is present.



Fig. 331 —Method of palpating the gall bladder or pylorus (Eisendrath Surgical Diagnosis) The patient should be laid upon the back with the shoulders slightly raised and thighs flexed upon the abdomen so that the soles of the feet rest squarely upon the bed. The examiner should approach the patient from the right, laying the hand flat upon the abdomen and insert it gradually deeper while the patient is instructed to breathe and thus relax the abdominal wall.

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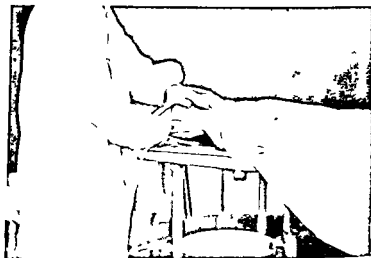


Fig. 333.—Method of examination to determine abnormal mobility or enlargement of the kidney. Eisendrath: *Surgical Diagnosis*. This method is also used in the determination of the presence or absence of an enlargement of the kidney. The right hand of the examiner when examining the right kidney is placed behind the patient in a space between the last rib and the crest of the ilium so that the parts lying behind the kidney can be raised up to meet the opposite hand which is pressed down upon it. When examining for a floating kidney the lower pole of the kidney can be felt to slip across the hand lying on the anterior surface of the abdomen.

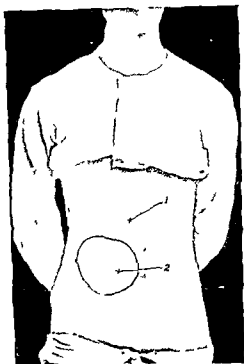


FIG. 333.—The areas of fulness in a case of encapsulated intraperitoneal fluid (Isenkrath—*Surgical Diagnosis*). 1 Indicates the size of the encapsulated abscess, which was of a tuberculous nature, lying between the abdominal wall and the agglutinated coils of intestines within the peritoneal cavity, extending upward between the right lobe of the liver and the thoracic wall. 2 Indicates the area of external prominence on account of which the case was at first thought to be one of hydronephrosis.

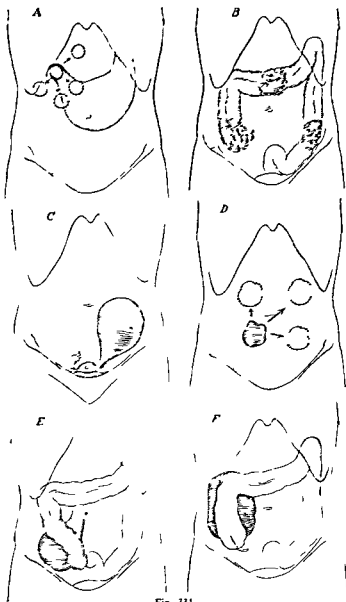


Fig. 334

Pain is also determined by palpation and may be of some value in the diagnosis. In connection with the presence of fluid let me remind you of the fact that an acutely dilated stomach may give rise to prominence and change in contour of the abdomen, and to fluid waves which resemble the presence of free fluid in the abdomen.

4 *Auscultation*—This method of examination is of little value except for the determination of fetal heart tones and for the examination of aneurysm and very vascular sarcomata.

5 *Special Methods of Examination*—This includes examination of the character of the fluids obtained by tapping, x-ray examination of the entire alimentary tract, pyelography, examination of the blood, including Wassermann tests, and a number of other methods which I shall refer to again in future clinics in connection with the tumors of the individual viscera.

Let me urge in closing that you familiarize yourself with one of the newer special methods, namely, pyelography, which will often enable you to differentiate whether a tumor arises from the kidney or not, and furthermore, whether it is a retention tumor, such as hydronephrosis of the kidney (Fig 335, A) or a neoplasm. If we obtain a normal pyelogram it shows at once either that the tumor has not invaded the kidney pelvis itself or that it is not in the kidney. I shall speak of this again

Fig 334—A Range of mobility in a case of tumor (carcinoma) of the pylorus

B, Location of tumors of cecum, transverse colon, and descending colon

C, Very movable tumor in lower abdomen in a case of pedunculated fibroid of the uterus

D, Marked range of mobility in a case of mesenteric cyst

E, Psoas abscess in right iliac fossa displacing cecum inward

F, Tumor of kidney lying behind inflated ascending colon

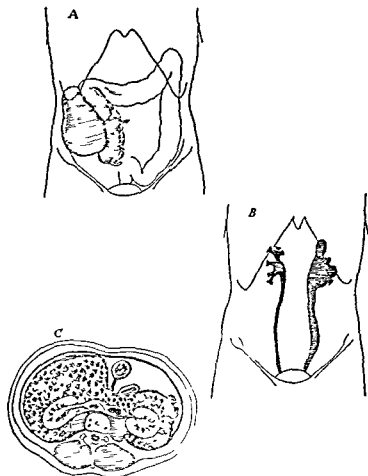


Fig 335—*A* Ascending colon displaced upward after inflation in a case of kidney tumor. This occurs when extensive adhesions are present and illustrates a source of error in the inflation test.

B, Pyelograms of renal pelvis. On right side is the pyelogram (obtained by use of thorium) of a normal kidney and on left side of a marked degree of hydronephrosis. This method has become a very important one in the differentiation of abdominal tumors.

C, Cross-section of abdomen showing extent of growth of a case of retroperitoneal lipoma (Reynolds).

CLINIC OF DR. BENJAMIN F. DAVIS

PRESBYTERIAN HOSPITAL

BULLET WOUND OF STOMACH

Summary A patient who was shot in the back two hours before entering the hospital, diagnosis of penetrating wounds of abdomen, inspection, importance of location of wounds of entrance and exit, the pulse rate, hemorrhage, abdominal rigidity, pain, tenderness, shock, shifting liver dulness, possibility of more than two wounds of stomach by a single missile, spontaneous healing of gastric wounds pathology, after treatment, choice of anesthetic bad results under spinal anesthesia, prognosis, importance of associated injury of other organs, types of wounds produced by bullets end result in present case

THIS patient is a plumber by occupation, age thirty-two years. About two hours ago he attended an election at a plumbers' union, at which there was considerable bitterness between rival factions. As this man entered the hall somebody began to shoot, our patient attempted a hurried exit, but just as he started to run down the stairway, he felt a terrific blow in the back and it was only by a great effort that he managed to cling to the banister and save himself from falling downstairs. He was given first aid at a nearby emergency station and has just now entered this hospital from a police ambulance.

You note that the patient is pale, his expression drawn and anxious, his body bathed in perspiration, he complains of intense abdominal pain, particularly in the left upper quadrant, you see how he retches at intervals, occasionally vomiting watery material. So far as we know there has been no bloody vomitus. The patient's one complaint is of the pain in the abdomen. Upon examination we find the skin cold and clammy, the pulse is rapid, about 120, but of good quality, the striking thing is the intense rigidity of the abdominal muscles. There is no abdominal distention, on the contrary, the abdomen is re-

tracted considerably and the powerfully contracting muscles of this young working man give the abdomen a markedly corrugated appearance. There is considerable general abdominal tenderness, most marked in the left upper quadrant. It is impossible to demonstrate shifting dullness, the area of normal liver dullness is not encroached upon. Posteriorly, we find a puncture wound about $\frac{1}{4}$ inch in diameter, which exudes a moderate amount of bright red blood. It is situated on the left side about $1\frac{1}{2}$ inches below and external to the tip of the twelfth rib, in a direct line with the long axis of the rib. There are no other wounds on the surface of the body. The absence of a wound of exit makes it exceedingly difficult to estimate the probable direction of travel of the bullet and we are averse to probing wounds of this type because of the practical certainty of carrying infection into the wound on the probe, and thus converting a relatively aseptic tract into a frankly infected sinus. Moreover, the location of the bullet is of little immediate importance as a rule, it is the possible injury of important organs with which we are immediately concerned, and, from this standpoint, a blind probe is of little value. It is in cases of this type that the x-ray may be of great value. In this instance, however, other signs are present which plainly indicate an exploratory operation and we have dispensed with the x-ray. A blood count has just been made, there is a leukocytosis of 12 000, the hemoglobin is 85 per cent. (Dare), and the blood pressure is systolic 110 and diastolic 80. The urine, drawn by catheter, is normal—it contains no blood.

On the basis of the intense abdominal distress and the vomiting it seems certain that the bullet has entered the peritoneal cavity and wounded some abdominal viscus, though it may be that the symptoms are produced by intraperitoneal hemorrhage. The absence of blood from the urine and of macroscopic blood from the vomitus suggests that stomach and kidney may have escaped, although at this time, of course, nothing but exploration can prove it. Not knowing the direction of travel of the bullet we can only state that some organ in the left upper quadrant appears to have been injured.

While the patient is being prepared, I shall discuss the question of penetrating wounds of the abdomen, basing my remarks on experience in civil practice, and also upon the results of some very careful studies on large numbers of patients passing through the hospitals of the War Zone¹ With all possible care and an extensive experience and a full appreciation of the numerous fallacies, it is frequently difficult to make sure that an abdominal wound is penetrating If it is difficult when there is an entrance and exit wound, it is still more so when there is only one wound It may be that shock, hemorrhage, rigidity, or rapid pulse will be present, in some cases which are seen early there will be no such guides It may be said that the wound of a hollow viscus has in itself no symptoms if it is not extensive enough to produce shock, it is usually hemorrhage or peritonitis which gives the danger signal As there is a distinct relation between the interval since the receipt of the wound and the mortality, it is important to be able to determine the probability of penetration Experience has shown that one has to be very careful in making a negative diagnosis, and it has also shown the wisdom of operating in doubtful cases

Anteroposterior wounds are the easiest to judge The only point to be remembered is the thickness of the flank muscles Below the transpyloric plane a wound with the entrance on one side of the midline, and an exit exterior to the lateral body line of the same side, is very often non penetrating, or it may have just opened the peritoneum Above the transpyloric plane such a wound owing to the rounded form of the thorax, is almost certain to be penetrating The bullet which passes in and out between the semilunar lines probably does not open the abdomen, while the wound that passes in and out outside this line probably does In a longitudinal direction the bullet which enters near the costal margin and emerges above the groin will most likely traverse the abdomen Where it is a question of single wounds there is really no guide except the symptoms, as it is usually impossible to tell the direction of the projectile

¹Cuthbert Wallace, A Study of 1200 Cases of Gunshot Wounds of the Abdomen *Brit Jour of Surg* 1916-17 vol iv p 679

Much help is afforded by an x ray apparatus in such cases. As a rule, such patients look ill, are shocked and cold, but exceptional cases may be of fair color even with cold clammy extremities and thready or even absent pulse. The pulse is a valuable guide. A rapid pulse, a pulse that does not fall or a rising pulse is an indication for operation, the rising pulse usually indicates either hemorrhage or peritonitis and sepsis. A pulse-rate of 100 is very common and suggests a good prognosis. A pulse of 120 seems to be the critical rate—of 145 patients with a rate over 120 only 16 recovered. Patients with abdominal injuries nearly always vomit and the presence of vomiting therefore is of little significance with regard to the question of penetration. Hematemesis of course suggests injury to the stomach, while the absence of vomiting may be taken as very good evidence that the stomach is not involved. With hemorrhage we have the ordinary clinical signs but they are not helpful. In order to produce these signs the amount of blood lost must be very great. Restlessness, blindness and air hunger therefore are usually absent. Blanching and rapid pulse while frequently present cannot be considered indicative of hemorrhage because they are produced by many other causes. Abdominal rigidity is usually present. We must remember in this connection however that abdominal rigidity may result from rather superficial wounds and also is not infrequently seen following spinal injuries. Abdominal tenderness usually is a relatively late sign indicating peritonitis. Pain is nearly always present may be of exceeding severity and frequently appears to center about the site of injury. There is always a certain degree of shock which tends to vary to a large extent with the severity of the hemorrhage. Some surgeons lay a great deal of stress on the obliteration of the normal liver dulness in the diagnosis of perforation of the stomach and duodenum.¹ In every case of perforation gas and fluid are present in varying amounts in the free peritoneal cavity. The gas may pass between the liver and diaphragm as shown by the x ray and cause

¹Field, Gastroduodenal Perforation, a New Diagnostic Sign, Boston Med. and Surg. Jour. 1918, vol. 18, p. 270

obliteration of liver dulness. Much dependence cannot be placed on liver percussion as ordinarily practised because of the great variations both in health and disease. If we change the patient's position, free fluid will flow to the dependent part and the air will rise to the top. This will intensify the diagnostic findings—tympany over a wide liver area and again flatness over the same area on change of position. Normally there is a change in the liver percussion note on change of posture. This has been noted in a large number of normal cases examined but in none of them were the results similar to those in the cases of perforation reported by Field. Normal liver changes must be recognized however before positive deductions are made. Usually this sign is not of great importance. If absent in the presence of other positive signs of perforation it may be disregarded but if present in doubtful cases it may be the deciding diagnostic factor.

The patient has been prepared and I am making my incision over the middle of the left rectus muscle from the rib margin down to about the level of the umbilicus. Opening the peritoneal cavity a small amount of fluid escapes the stomach comes immediately into view and on its anterior wall about $1\frac{1}{2}$ inches above the middle of the greater curvature is a perforation through which mucous membrane protrudes. There is no material escaping from this wound. It is rapidly closed by two purse string sutures (Fig. 336 1). Since the bullet entered the back we are certain that the posterior wall of the stomach has also been wounded. Tearing through the great omentum we find at a point directly opposite the hole in the anterior wall a similar perforation on the posterior wall of the stomach through which stomach contents are escaping. This also I close with a purse string overlaid by a Lembert suture and then search for other wounds (Fig. 336 1 2). The mere fact that an anterior and posterior perforation has been discovered and closed does not rule out the possibility of other perforations. Norman Kerr recently described such an instance. The patient a man of about sixty was shot in the back about one half hour after he had eaten a heavy meal. The bullet divided the right ureter after



Fig 336

entering the pelvis of the kidney, then made three perforations of the right portion of the stomach about 2 inches to the left of the pylorus one on the posterior wall one in the anterior wall just opposite, and another on the lesser curvature just above the line of the other two—this last one was overlooked and the patient died in twenty hours. The explanation of such an accident is as follows: There are usually three contraction waves in the digesting stomach which can be seen on the fluoroscopic screen at the same time and each wave as it passes toward the pylorus becomes quite deep thus making it possible for a bullet to grab or even perforate the tip of one of these inverted crests as it passes through the stomach.

It is possible that a patient may survive a perforation of the stomach there are a number of such instances on record. When such wounds heal spontaneously they produce small herniated diverticula of the mucous membrane the production of which is explained in the following manner: when the stomach is perforated the mucous membrane immediately protrudes through the opening and may even plug it sufficiently to prevent leakage the herniated mucous membrane remains herniated and gradually becomes covered with a layer of fibrin which slowly organizes and seals the hole the herniated mucous membrane still forming a diverticulum.

I have explored the lesser peritoneal cavity and the region in the neighborhood of the wound of entrance and can find no evidence of injury to other structures in that locality. As it is possible however that I may have missed a wound of the tail of the pancreas or of the left ureter I will insert a cigarette drain deep in the left hypochondrium and close the wound in layers. Ordinarily drainage is not required in gastric perforations which are treated early, and irrigation of the peritoneal cavity also, as a rule, is not required. Simply mopping up of the escaped gastric contents as I have done in this instance is sufficient.

Fig. 36.—1. Abscess opened percutaneously in a testis wall of rat each pressure pump-syringe is in place preparatory to closing perforation.
2. Closure of perforation in posterior wall of stomach by 10 silk sutures
and by 10 eubert sutures



Fig 336.

on the amount of hemorrhage that has taken place and on the association of wounds of other organs, the amount of peritonitis present does not appear to depend very directly on the length of time between the injury and the operation. As has been noted, spontaneous recovery may occur. In the Cuthbert Wallace series there were 82 cases of stomach wounds, only 27 of which were associated with wounds of other portions of the intra abdominal gastro intestinal tract. Of 55 cases of stomach suture without involvement of other organs, 29 died. Of 27 cases associated with other operations on the intestinal tube, 21 died. The mortality uncomplicated with injury of other hollow viscera was 52.7 per cent, with other hollow viscera involved 77.8 per cent. There were a small number of pancreas and spleen injuries associated with stomach injuries, but the series was too small to warrant definite conclusions, although most of these patients died and it was suggested that such complications made the prognosis very grave.

Postoperative complications which may arise following gunshot wounds of the stomach are ulceration, secondary hemorrhage, perforation and local abscess—the latter, in stomach cases, is usually subdiaphragmatic.

In conclusion I would like to say a few words in regard to the type of wounds produced in the stomach by bullets. Bullets passing anteroposteriorly as a rule make small wounds, such as the ones which we have just seen. When the axis of flight of the projectile is more or less parallel to the walls of the stomach, the wounds become larger, sometimes cutting the entire wall of the stomach for a great distance, sometimes a mere linear slit in the outer coats followed by perforation, when the projectile passes in through the epigastrium and out by the axilla. The wounds tend to become parallel to the greater curvature, when the missile takes a more vertical course the wounds are inclined at an angle to the greater curvature, and the anterior wall of the stomach, or its antral portion, may be almost completely divided. Projectiles hitting the greater or lesser curvature in an anteroposterior direction sometimes cause rather extensive V shaped injuries involving both walls. Bruises or

We will send this patient back to his bed. He may lie flat or be elevated on pillows, according to which position is the most comfortable. He will be given 8 to 10 ounces of normal salt solution per rectum every four hours, nothing by mouth and enough morphin to prevent great suffering. In about thirty six hours we will allow small quantities of water by mouth, to be followed in twelve hours by regular feedings of milk and Vichy, each $\frac{1}{2}$ ounce every hour, quantity to be increased the following day, and about the fourth day we will allow strained gruels, soft boiled eggs, and cereals in addition to the milk, and in from ten days to two weeks have the patient back on a full tray. If he shows any tendency toward hyperchlorhydria we shall continue his milk and cereals over a longer period and add alkalis between feedings. We commonly use sodium bicarbonate and calcined magnesia, or sodium bicarbonate and calcium carbonate, each 10 grains, as the alkali.

While operating on this patient we have used ether anesthesia. General experience seems to indicate that ether should be the anesthetic of choice in most cases of this type. Quite uniformly bad results have followed spinal anesthesia in operations for gastro-intestinal perforations. The spinal anesthesia seems to greatly enhance the tendency of such patients to sink into deep shock, from which they do not recover. The results under chloroform, while better than those obtained under spinal anesthesia, are not nearly as favorable as those obtained by ether. Local infiltration anesthesia, while to be considered, probably would not be satisfactory, because of the marked increase in operating time necessitated by its use, and because of the wide exposure frequently necessary in these cases, which would be very difficult to obtain readily and quickly in the ordinary infiltration anesthesia.

The prognosis for this patient should be very good. It is well known that the mortality following gunshot wounds of the gastro intestinal tube is directly proportional to the time elapsing between the receipt of the injury and suture of the perforation. The maximum period of successful suture after injury is approximately thirty six hours, and the prognosis depends largely

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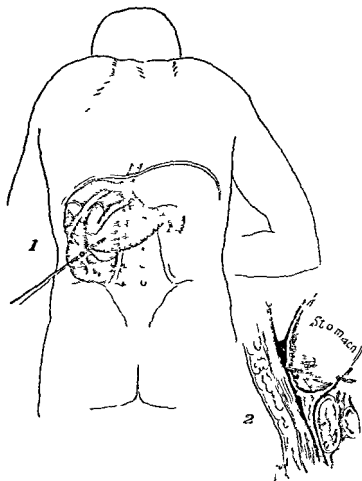


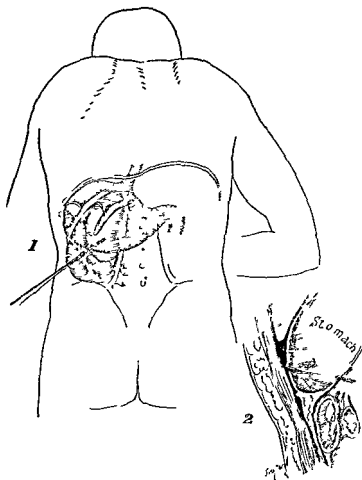
Fig 337—1 Point of entrance and probable course of bullet, lateral to kidney and medial to descending colon entering the lower border of the stomach. The patient is shown in outline in a stooping posture simulating that which he assumed while running for safety this helps to explain how the

cuts in the peritoneum or muscular coats without perforation are not infrequently met with. They may occasionally give rise to general peritonitis. Hemorrhage, when it occurs, is frequently quite severe, and comes from the vessels on the surface of the stomach rather than those in the stomach wall.

Having the abdomen closed, what shall we do with the wound of entrance in the back? (Fig 337, 1) There seems to be some difference of opinion in regard to the management of these wounds. Cuthbert Wallace concluded that excision was not necessary. Many other surgeons in the War Zone excised such wounds as a matter of routine. In civil practice there is rarely any reason for doing anything more to a wound of this type than mere cleansing with peroxid or tincture of iodine and the application of a sterile dressing. Such will be our procedure in this case.

Postscript—The patient made an uneventful recovery and was discharged from the hospital on the twenty first day after operation. Wounds completely healed.

The patient was very anxious to know the fate of the bullet which had entered his body and which we had not found at the operation. Careful x-ray examination of his entire abdomen and pelvis was therefore made before he left the hospital, but no evidence of the bullet was found. It seems probable that the bullet, after entering the stomach, perforated but did not pass through the anterior wall of the stomach in its entire length, spent its force on striking the anterior abdominal wall which was in contact with the stomach, and then dropped back into the gastric cavity (Fig 337, 2). It was probably ejected in the vomitus during the course of the rather violent attacks of vomiting which the patient experienced before reaching the hospital.



1, Bullet missed kidney and colon and reached the stomach. 2, Bullet has

CLINIC OF DRS KARL A MEYER AND W F MONCREIFF

COOK COUNTY HOSPITAL

URINARY EXTRAVASATION

Summary Etiology of urinary extravasation spontaneous cases nearly always sept c pr nc ples of treatment suprapubic puncture not followed by permanent drainage indefens ble

EXTRAVASATION of urine from the bladder or urethra into the surrounding tissues may be considered as traumatic or non traumatic (spontaneous) There are four important groups of the traumatic cases from the etiologic viewpoint The first includes severe trauma oftentimes crushing injuries with fracture of the pelvic girdle and sometimes a concomitant injury to the rectum A second group comprises penetrating wounds of the bladder or urethra In the third group we have a relatively slight trauma to an overdistended bladder Rupture of the urethra by instrumentation forms a very important group in which trauma is the determining factor notwithstanding the fact that the sounding or catheterization is undertaken with the object of relieving an obstruction and retention of urine due usually to an organic stricture

Retroperitoneal or perirenal extravasation of urine may occur from trauma of the first or second type mentioned involving the pelvis of the kidney This is what occurred in one of the patients (E M) presented to you

Non traumatic or so called spontaneous extravasation of urine occurs as a result of urethral obstruction which means practically always gonorrheal stricture and its consequent pathology A very important clinical feature of these cases is the septic urine, which the stagnation and retention invariably

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produce We have two patients illustrating this type of extravasation

In the case of this boy (E M) of fourteen, we have dealt with a traumatic extravasation of urine from the kidney pelvis He was admitted to the hospital about four hours after sustaining a compression injury (between two vehicles), complaining of pain and tenderness over the left side of the abdomen and vomiting He did not lose consciousness at the time of injury or afterward About one hour after the accident he vomited, and since then three or four times before entering the hospital There was abdominal tenderness and rigidity, more marked on the left side, where there were also some skin abrasions His temperature, pulse, and respirations were normal, and his general condition good A diagnosis of kidney injury was made Exploratory laparotomy revealed discoloration and infiltration of the retroperitoneal tissues lateral to the descending colon, there was a complete rupture of the pelvis of the kidney, with infiltration of a considerable amount of urine into the perirenal tissues The renal vessels were intact, and consequently there had been no bleeding of consequence There was no intraperitoneal injury An immediate nephrectomy was done, no drainage was used, as sterile urine causes little if any reaction, and is rapidly absorbed unless necrosis occurs

Postoperative Note—An uneventful recovery followed the operation, and the patient was able to leave the hospital in two weeks

Our next patient (J H), a railway switchman is a typical example of the very important group of cases of spontaneous extravasation of septic urine due to chronic urethral obstruction This man was admitted to the hospital complaining of pain and marked swelling of the scrotum, perineum and lower abdomen and inability to urinate Two and one-half years ago he had acute gonorrhea, self treated which continued as a chronic process from that time to the onset of the condition for which he now seeks relief For some time before this acute condition appeared he had noticed that the urinary stream was small, and just a week before, following some heavy work, he was

seized with chills. A few days afterward, swelling, localized tenderness of the perineum and scrotum appeared, and this was followed by swelling and soreness of the penis, with extension of the same condition upward into the suprapubic region. Before entering the hospital he had been using hot dressings, ointment, and methylene blue under the direction of his family physician. He states that there had been no previous attack of a similar kind.

The patient was acutely ill on admission to the hospital. Temperature was 100° F, pulse 120, respirations 28. Leucocyte count 17,600. Swelling, tenderness, and rigidity were marked over the lower abdomen, especially the suprapubic region, much less intense over the upper abdomen. The tenderness appeared to be in the abdominal wall itself. Some redness of the skin was present toward the base of the penis. The external genitalia were markedly swollen and distorted, the scrotum being swollen to 10 inches diameter and very tense, red and tender. The penis was swollen and distorted and large areas of the skin were black in color, due to gangrene. Urine was dribbling from a fistula at the junction of the penis and scrotum. The perineum was swollen, red, tense, and tender. Considerable tension and tenderness of the perirectal tissues was revealed by rectal palpation.

Operation—Under ether anesthesia a suprapubic cystotomy was done, liberating about 2 liters of putrid urine. A large rubber tube was sutured into the bladder for permanent drainage. Multiple incisions were made into all the swollen and infiltrated tissues of the abdomen, scrotum, and penis and hot dressings with saturated boric solution applied.

Postoperative Course—Sitz-baths of twenty minutes each were used twice daily, increasing the duration as the strength of the patient returned, urotropin and acid sodium phosphate were given by mouth. For several days there was a profuse foul discharge from the infected tissues, with separation of gangrenous sloughs; the discharge soon ceased.

After-treatment—After five weeks the suprapubic wound was entirely closed, and the remaining wounds were healed so that

produce We have two patients illustrating this type of extravasation

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the lumen of the urethra by a very thin wall. With the primary septic extravasations should be included the group of traumatic cases in which the urethra is ruptured by instrumentation, in an effort to empty the bladder from below. The chronic urethral obstruction with which we are dealing in these cases is practically always the result of gonorrheal strictures which are

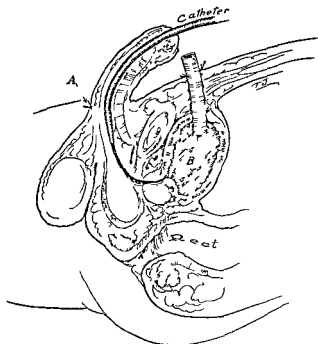


Fig 338—Impassable stricture at penile-scrotal junction incised externally skin wound sutured and catheter anchored in urethra suprapubic drainage maintained until wound in urethra has healed

very often multiple. The acute retention which precedes extravasation is usually the immediate sequel of an alcoholic debauch.

The treatment is largely a matter of following accepted surgical principles. The indications are to establish drainage of the bladder in a rational manner to combat the infection of the infiltrated tissues and later to re-establish the continuity of

the patient was able to leave the hospital. He was then referred to Dr Harry Culver, who succeeded with filiforms and sounds in dilating the strictures to 24 F.

Our next patient (H. P.) is an example of the same type of extravasation. He entered the hospital because of swelling of the penis and scrotum and inability to urinate. Extreme difficulty in urination had been present for three days. There is a history of more or less urinary obstruction, dating back to an attack of acute gonorrhea eight years before, but no previous acute condition like the present trouble. The penis and scrotum were very greatly swollen, the perineum not affected. The marked infiltration of the penis precluded any attempt to relieve the obstruction from below. The bladder was drained by a supra pubic cystostomy, and a retrograde catheterization performed. An impassable stricture was found at the penile scrotal junction, which was incised externally, and a retention catheter sutured into place. Suprapubic drainage was continued for one week to allow healing of the urethra, the wound was then allowed to close (Fig. 338).

The observations of Wolfer (S. G. O., 1918, xx, 56-296) on this subject coincide closely with my own experience in dealing with these cases. The seriousness of urinary extravasation is influ

the tissues, with very little reaction and absorption without ill effects provided the injury to the urinary tract receives prompt surgical treatment, before necrosis and secondary infection occur as a result of a continued infiltration and decomposition of the urine. This benign course is usual in extravasation of the purely traumatic variety.

Spontaneous extravasation on the other hand means an infiltration of the tissues with septic and decomposed urine. Rupture of the urethra in these cases results from continued straining in an effort to empty the bladder. This takes place the more easily when there are ulcers of the mucous membrane behind the stricture, or a peri urethral abscess separated from

RETROPERITONEAL WOUNDS OF THE COLON

Summary Report of case, with autopsy findings high mortality of retroperitoneal wounds of the colon pathology treatment

We all admit the great value of mistakes as teachers of medicine In presenting this autopsy report I trust that it may serve to bring home to us the importance of and the diagnostic difficulties associated with extraperitoneal wounds of the colon

History—J A, a male Italian laborer, aged twenty two, entered the Cook County Hospital April 24, 1919, bleeding from a gunshot wound of the trunk About one hour before admission he was shot from behind by a union laborer because of a labor dispute Some bleeding from the wounds occurred in transit to the hospital

His previous health had always been good, personal and family history contained nothing of significance

Physical Findings—When first seen the patient was in great pain and exhibited a moderate degree of shock, there was bleeding from a wound of entrance in the left lumbar region, situated at the level of the third lumbar vertebra, about 1 inch to the left of the midline The wound of exit was situated on the left side, about 1 inch above the iliac crest, midaxillary line, and there was also bleeding from this wound A superficial wound tract about 3 inches long of no consequence, beneath the skin and superficial fascia, was found laterally over the left eighth and ninth ribs There was diffuse tenderness over the left half of the abdomen with slight rigidity of the abdominal wall No other physical findings of any significance were noted

Diagnosis—Perforation of an abdominal viscus was suspected, and a laparotomy was done at once

Operation—Abdomen opened through left paramedian incision below umbilicus Careful exploration revealed no visceral lesion, no perforation of the peritoneum Palpation through

the urethra by the methods most applicable to the conditions as they exist in each individual case. Suprapubic puncture, though still employed in some quarters, is a dangerous and unsurgical procedure, usually being followed by severe or even fatal infection. The reasons for this are fairly obvious. There is no peritoneal covering at the site of the puncture in the bladder wall to seal the opening, even if there were, it is doubtful whether the danger would be eliminated. As the bladder refills urine leaks through the valve like puncture tract into the reticular tissues of the prevesical space, whence it infiltrates the perivesical tissues back to the anterior aspect of the rectum initiating an infection in this region very difficult of surgical access. Suprapubic puncture is indefensible under any circumstance unless perhaps one immediately afterward establishes continuous drainage by suprapubic cystostomy. The method of choice in these cases then, is immediate suprapubic cystostomy, multiple incisions, and free drainage of the infiltrated tissues, with hot fomentations to the infected tissues, sitz-baths, and urinary antiseptics by mouth. Irrigation of the bladder may be done with advantage. The prognosis is obviously the more favorable the earlier the diagnosis and the surgical intervention are made. Later after the sepsis has been cleared up, and the patient is in good general condition, the continuity of the urethra is to be re-established either by dilatation from below, retrograde sounding and external urethrotomy or internal urethrotomy, or a combination of these measures according to the special conditions met with.

of the wounds of the colon met with on the British and French fronts extraperitoneal injuries formed a rather considerable proportion. These wounds are nearly always produced by missiles which enter the loin or lumbar region just lateral to the vertebral column and pass outward on the same side taking an oblique forward direction in their course through the tissues. Intraperitoneal and extraperitoneal wounds of the colon have sometimes been found coincidently either at operation or autopsy.

Several factors are responsible for the high mortality of these retroperitoneal lesions. Exact figures are not available but a mortality of 90 per cent as compared with an average of 50 to 60 per cent in the purely intraperitoneal wounds is probably not an overstatement. The first important factor to be considered is that of diagnosis. The ordinary anterior laparotomy incisions do not give an adequate opportunity to gain information as to the presence or location of a retroperitoneal wound of the colon. Furthermore the presence of through and through wounds of the peritoneal surface does not exclude the possibility of further retroperitoneal wounding. The areolar character of the retroperitoneal tissue makes it difficult to find these wounds even when exploration is made through a lumbar incision. Many of them are small and tend to remain partly closed. Hemorrhage into retroperitoneal tissues particularly the massive retroperitoneal hematoma that is a fairly frequent accompaniment of these lesions adds further to the difficulty of finding them. It is anything but an easy task to suture the bowel wall in this locality due partly to the lack of a peritoneal coat partly to the difficulty of access to the region. Owing to this latter consideration wounds in the region of the splenic flexure are the most difficult to manage.

A second factor of perhaps greater importance than the other is the extreme virulence and rapid course often exhibited by infections of the retroperitoneal tissue. Infection may be initiated either by leakage of the bowel content or by material carried in by the projectile the latter cause is of greater importance in war wounds than in those met with in civil practice.

the peritoneum outlined the track of the projectile which had torn its way through the deep lumbar muscles on the left side. The abdomen was closed in the usual manner.

Postoperative Course—The patient left the operating room in good condition and apparently continued to do well for the next eighteen hours. He then became restless, began to vomit, and complained of considerable abdominal pain. There was a slight rise of temperature (99.5° to 100.2° F), respirations increased to 28 or 30, pulse averaging 124 to 130. The next day a moderate distention of the abdomen was noted—vomiting continued at intervals and there was a slow progressive increase in pulse-rate and respirations. The temperature remained at about 100° F. A diagnosis of peritonitis was made and on the evening of the second day after operation, under gas anesthesia, a drain was inserted through the lower angle of the laparotomy wound. The condition nevertheless continued to grow progressively worse with increasing abdominal distention, severe pain in the abdomen and left lumbar region, hippocratic facies, fever of 104° to 105° F, and a continued increase in pulse-rate and respiration. Restlessness increased to delirium, respirations became irregular, shallow and entirely costal. Death occurred at 2:40 P. M. April 28, 1919, the third day after operation.

Postmortem Findings—The cause of death was a retroperitoneal wound of the colon at the splenic flexure with secondary septic cellulitis of the retroperitoneal tissues from leakage of bowel content and septic peritonitis, the infection having involved the peritoneum apparently by direct continuity from the retroperitoneal tissues. It was found that the projectile had not penetrated the peritoneal cavity nor produced any wound of the peritoneum.

Retroperitoneal wounds of the colon are associated with a very high mortality under all circumstances. Furthermore the anatomic conditions are such that owing to the absence of a mesentery of the ascending and descending colons these portions of the large bowel are especially liable to injuries of this type. For the same reason the duodenum is also very liable to retroperitoneal injury. Cuthbert Wallace states that

CLINIC OF DR HUGH McKENNA

ST JOSEPH'S HOSPITAL

POSTOPERATIVE HERNIA. NECESSITY OF APPROXIMATING FASCIAL LAYERS LOCAL ANESTHESIA AS A PREVENTIVE OF RECURRENCE

THIS patient was originally operated on for appendicitis, at which time an incision was made through the right rectus muscle. I must condemn this incision, as it destroys the action of the muscles and retards healing because of the muscle paresis. The patient was operated on for the repair of the hernia on two previous occasions, but each time it recurred. In the repair of this hernia this morning I shall attempt to carry out the Mayo operation of flap over flap.

The patient is now prepared for operation, which I shall do under ether anesthesia. I am making my incision through the old scar. The upper flap is now free, and I am carrying my dissection well back under the skin and then freeing the lower flap. It is not necessary to separate the fat from the upper flap, but the lower one must be entirely clean and fat free in order that the fascia overlying the muscles may come into intimate contact with the parietal peritoneum on the under surface of the upper flap. I am working with the fingers of one hand in the abdomen in order that I may more safely make my dissection and avoid the possibility of cutting through a little pocket of the hernial sac that might contain adherent bowel. I am freeing the skin from the old scar which is very extensive, before attempting finally to prepare the lower flap. A principle that must be kept in mind in the repair of any type of hernia is that the two fascial layers must be brought together rather than an approximation of muscle to muscle or muscle to fascia. In the

No mention seems to have been made by others of the occurrence of general peritonitis by extension from the retroperitoneal sepsis, which was a special feature of the picture in the present instance. Drummond and Dunn have called attention to a special type of wound met with in military surgery, in which the projectile does not perforate the bowel directly, but the escape of fecal material into the retroperitoneal tissue, and consequent infection, results from a rapid ulceration of the mucosa. This ulceration is said to occur within a few hours of the injury, and is due to separation of the muscular wall and submucosa from the mucous membrane with consequent loss of blood supply to the latter. The mechanism concerned in the production of this type of injury is thought to be the dragging force exerted by the projectile on the tissues surrounding its pathway.

The principles to be followed in dealing with extraperitoneal wounds of the colon, as contrasted with the intraperitoneal variety, are few, but important. The position and course of the track of the projectile in the body, as indicated in a general way by the location of the wounds of entrance and of exit (*when the latter is present*), deserve special consideration. If these are so situated as to indicate a reasonable possibility of a retroperitoneal lesion of the bowel, it is probably safer to explore than not. A posterolateral lumbar incision should be made, so placed as to admit of careful and thorough examination of the entire wound tract in the colon region of the side in question. Suture of the wounds in the bowel wall should be done if practicable, in any event, *free drainage is of the greatest importance.*

In conclusion, it may be stated that in view of the special liability of the retroperitoneal tissues to infection, and of the technical difficulties attending the operative treatment of these lesions of the colon their mortality will probably continue to be high even under the most favorable conditions.

In this case the remnants of the recti have retracted into a large muscular ridge on either side, making the umbrication operation difficult and also preventing the possibility of bringing the recti together. In the repair of large hernias many times we close the sac on the inside, and that method is a much safer one, particularly in the sliding type of hernia and is a principle that may be utilized to a certain extent in any large hernia. Indeed, in a large inguinal hernia the lateral wall of the sac many times is made up of a part of the mesocolon which manifestly cannot be removed and yet the sac must be closed. This can be done best by a closure of the sac from the inside. In the first operation this morning, which we did under local anesthesia, it was necessary to close the hernial sac from the inside.

The anchor stitches are now in place. After these anchor stitches are pulled together I will attempt to carry out the principle I have already laid down that is the approximation of the upper surface of the lower flap to the under surface of the upper by means of a row of interrupted chromicized catgut sutures applied in the trough of the wound. The flap is now pulled down with three heavy silk sutures. The purpose of applying the sutures in the trough is to prevent the protrusion of a tongue of fat or omentum. A thing we must not overlook in these cases is that the lessening of the intra abdominal space increases the pulmonary congestion and sometimes leads to a fatal issue both from pneumonia and pulmonary edema. The skin is closed with silkworm gut. In the dressing of these cases heavy strips of adhesive are passed around the abdomen to the back in order to relieve the strain on the stitches during the first twenty four hours, especially when the patient is coming out from under the anesthetic.

approximation of the fascial layers the operator must be careful not to leave a site for a potential hernia, which means that the layers of fascia must be very closely approximated in order to prevent a portion of the fat or omentum protruding between the approximating sutures, as when coughing or a sudden effort produces a strain on the abdomen there is very frequently a recurrence of the hernia. In a large number of hernias, probably 900 operated on in the service of which I was in charge during my active service in the army, where for the first period we were able to observe the patients operated on for a period of seven months, we had an excellent opportunity to note the possibilities of recurrence in patients who went into active duty immediately upon being discharged from the hospital. These operations were in the great majority of instances for various types of inguinal hernia, although every type, including postoperative hernias, were referred to the surgical department. Our conclusion in connection with this work was that doing the operation under local, thereby minimizing the coughing and vomiting after operation and the possibility of forcing tissue between the approximated layers, very markedly reduced the number of recurrences. In the operation for inguinal hernia particularly the direct type, a modified Andrews' operation was used in the majority of cases, and in this operation great care was exercised after putting in the mattress sutures to bring the upper cut edge of the aponeurosis of the external oblique down to the shelving portion of Poupart's, and to make this step of the operation doubly secure before tying the mattress sutures a fine catgut continuous suture was utilized to bring this cut edge into immediate contact with the shelving portion of Poupart's. The lower cut edge of the aponeurosis was brought up over the cord and sutured to the superficial fascia. I may say in passing that the superficial fascia in this region in a large percentage of the cases is a well-developed fascia. A subcutaneous suture for closure was used in a fair percentage of these cases, and led us to the conclusion that the immediate approximation of the skin edges was a very important factor in preventing the possibility of infection, thereby reducing the number of cases of recurrence.

RESECTION OF TIBIA—REPAIR OF DEFECT BY TRANS- PLANTATION OF BONE FROM OPPOSITE TIBIA— SKIN GRAFTING BY PEDICLED FLAP METHOD

THIS patient was operated April 7, 1917. The wound having for years been badly infected, it was necessary to remove all the sloughing tissue and the entire lower 7 inches of the tibia. Following operation the wound was treated with Dakin's solution until completely clean. Then a graft $9\frac{1}{2}$ inches long was removed from the opposite tibia and transplanted into the defect. When an attempt was made to close the wound it was found that there was not enough skin to cover the transplant and only by splitting the tibialis anticus was it possible to get enough soft tissue to cover the graft. However, the graft healed in and the wound finally closed, leaving a very thin layer of soft tissue over the graft. The patient left the hospital June 30, 1917. As I had to leave for military service and could not keep the case under observation, the patient began using the leg earlier than she should with the result that she fractured the graft at the point where the soft tissue was thinnest. When I finally had an opportunity to operate on the case I found that the repair of the fracture had increased the size of the bone graft, thereby necessitating the application of a heavy skin graft. This was done by cutting out a tongue-shaped pedunculated flap of skin and fat down to the fascia lata on the outer side of the right thigh and applying it to the defect over the angle the flap being held in position by means of a plaster-of Paris cast for three weeks. The flap was then detached without anesthetizing the patient. It is now five weeks since the flap was detached and you can see that it covers the defect beautifully (Fig. 339).

This case is presented with considerable interest because it shows certain principles in plastic operative surgery that can be brought about where the surgeon will give the time and extreme care necessary to get these results, and where the patient, in turn, is willing to give the necessary time.

RESECTION OF TIBIA—REPAIR OF DEFECT BY TRANS- PLANTATION OF BONE FROM OPPOSITE TIBIA— SKIN-GRAFTING BY PEDICLED FLAP METHOD

THIS patient was operated April 7, 1917. The wound having for years been badly infected, it was necessary to remove all the sloughing tissue and the entire lower 7 inches of the tibia. Following operation the wound was treated with Dakin's solution until completely clean. Then a graft 9½ inches long was removed from the opposite tibia and transplanted into the defect. When an attempt was made to close the wound it was found that there was not enough skin to cover the transplant and only by splitting the tibialis anticus was it possible to get enough soft tissue to cover the graft. However, the graft healed in and the wound finally closed, leaving a very thin layer of soft tissue over the graft. The patient left the hospital June 30, 1917. As I had to leave for military service and could not keep the case under observation, the patient began using the leg earlier than she should, with the result that she fractured the graft at the point where the soft tissue was thinnest. When I finally had an opportunity to operate on the case I found that the repair of the fracture had increased the size of the bone graft, thereby necessitating the application of a heavy skin graft. This was done by cutting out a tongue-shaped pedunculated flap of skin and fat down to the fascia lata on the outer side of the right thigh and applying it to the defect over the angle, the flap being held in position by means of a plaster of-Paris cast for three weeks. The flap was then detached without anesthetizing the patient. It is now five weeks since the flap was detached and you can see that it covers the defect beautifully (Fig. 339).

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Fig 339—Resection of tibia. 1 Cutaneous defect at site of healed fracture in transplant. 2, Pedicled flap stitched in position. 3 4 Site of removal of graft from thigh and its new location on the leg after healing occurred. Note that the wound in thigh, as indicated by the stitch holes, was closed by suture.

DESTRUCTION OF FIBULA FROM OSTEOMYELITIS— TRANSPLANT TO REPAIR DEFECT

THE next case I wish to present this morning is a girl twelve years of age, whose left fibula was practically entirely destroyed from an osteomyelitis occurring a year and a half ago. There

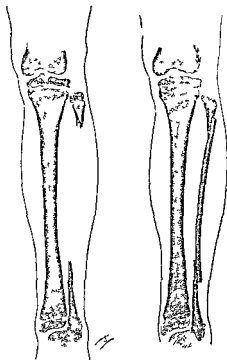


Fig 340 —Destruction of fibula. Sketch made from x ray picture taken before and after defect in fibula had been filled by bone transplantation.

remains a segment of the head of the fibula $2\frac{1}{2}$ inches in length and a small delicate fragment at the lower end about $3\frac{1}{2}$ inches. This wound had been healed for over a year when the patient began to show eversion of the foot owing to the lack of sup-

port from the absence of a fibula. A graft 9 inches in length was taken from the tibia of the good leg, great care being exercised in removing this graft not to interfere with the epiphyseal areas. An incision about 3 inches in length was prepared in each end of the leg over the proposed new bed for the fibula and a long forceps was introduced through the upper wound and a path tunneled through the muscles down to the lower one. The graft was caught in the bite of a long forceps and pulled into place and made secure by the use of chromicized catgut applied around the ends of the graft and the segments of the fibula. The wounds were closed and the leg dressed in a posterior plaster-of Paris splint. The wound healed by primary intention. It is five weeks since the operation and the progress of the patient has been uneventful (Fig 340)

EMPHYEMA—REMOVAL OF PUS WITHOUT COLLAPSE OF LUNG THE GREAT ESSENTIAL

THE next patient is a child eight years of age, with fluid in the left pleural cavity. We aspirated 215 c c of the fluid. It was thought from the appearance of the fluid at the time of aspiration that it was pus. My experience in the management and observation of a large number of cases of empyema in the army has served to teach me that unless one gets positive cultures from these cases the pleural cavity should not be opened. My experience in the treatment of empyema has led me to believe that we should consider the keeping of the chest wall intact as an important factor in the handling of these cases. A review of the literature of the last couple of years will show that wherever the pleural cavity is opened according to the old plan of costal tectomy or thoracotomy the cavity is immediately contaminated with various types of bacterial flora. Two principles must be kept in mind in the treatment of empyema. The first is the removal of pus from the pleural cavity at the earliest time possible by an operation carrying the least amount of shock to the patient, and the second is to reduce the possibility of collapsing the lung to a minimum. I am of the opinion that the plan of operation worked out by my associate, Dr Victor P Diederich, and myself at Camp Pike contains these attributes.

The technic of this operation is as follows. After the determination of pus by laboratory tests, physical findings, and x-ray picture, a No 14 French catheter or a similar size Dakin's tube is introduced into the pleural cavity by means of a trocar and cannula. After the introduction of the cannula the trocar is removed, a catheter is introduced, and the cannula withdrawn. The trocar is introduced in such a way as to produce a valve action on the catheter, thereby preventing the introduction of air into the pleural cavity. The first pus that is removed by aspiration is sent to the laboratory, where 1 c c of the undiluted

pus is plated. The cavity is then washed out with Dakin's solution. This procedure is repeated five times each day and the pus sent every twenty four hours to the laboratory for plating in order to establish a control on the type of organism and the progress the case is making. I am of the opinion that the next most important factor in the treatment of empyema after removal of the pus is the prevention of collapse of the lung in order to preclude the possibility of the formation of a sinus. I believe few surgeons have come to realize the fact that the fewest number of sinuses will follow operation for empyema if they take into account in the original operation the prevention of collapse of the lung.

CLINIC OF DR HERMAN L KRETSCHMER

PRESBYTERIAN HOSPITAL

A CASE OF VESICOVAGINAL FISTULA

Summary Vesicovaginal fistula following hysterectomy for fibroids diagnosis methods of locating vaginal and bladder openings importance of careful cystoscopic exploration in the differentiation from ureterovaginal fistula complications their treatment technique of operation for closure of vesicovaginal fistula postoperative result in present case

MRS C P referred by Dr Rachel Yarros

Present Complaint—Loss of control of urine This loss of urinary control is more marked during the day when urine escapes every ten or twenty minutes During the night she has intervals of four hours without any escape of urine In other words as long as she lies on her back the urine does not leak As a result of this leakage of urine as the patient calls it she is obliged to wear pads continually She is confined to the house and is practically invalided

Onset and Course—In October 1917, an abdominal hysterectomy was performed for fibroids during which a severe hemorrhage occurred After the operation the patient noticed the onset of the present symptom This symptom has continued without any important change up to the present time

Physical Examination—The patient is a very large woman about forty years of age and not in any apparent distress

Head and neck are negative Heart and lungs are negative Abdomen is negative Nervous system negative x Ray examination for the presence of stone in the urinary tract negative

Examination of Urine—Clear straw colored neutral no albumin no casts Sediment negative Cultures sterile

Cystoscopic examination of bladder is completely negative except for the presence of a large opening situated near the right

ureteral orifice During the cystoscopic examination it was necessary to keep the irrigating part of the cystoscope going because the boric solution used for filling the bladder ran out of this opening almost as fast as it was introduced With a speculum in the vagina the fistulous opening could be seen. A ureteral catheter was then introduced through this vesicovaginal opening—it came out of this opening in the vagina.

The patient was told that she had a vesicovaginal fistula and operation for closure of the fistula was advised

In this case because of the large size of the fistulous opening no difficulty was experienced in locating the vaginal opening of the fistula, and for the same reason the vesical end was readily seen with the cystoscope

In instances where the fistulous opening in the vagina is small, difficulty may be experienced in finding it because of its small size Occasionally the fistulous tract because of its small size may be hidden in some of the vaginal folds. It may then be difficult to differentiate between a small vesicovaginal fistula and a ureterovaginal fistula. This point can be definitely determined, as a rule by ureteral catheterization Either the catheter cannot be passed up the ureter because of the injury to it, or if the catheter is passed, and a large catheter used, the leakage of urine will stop The vaginal opening may also be located by projecting a solution of argyrol into the bladder after having first introduced a speculum into the vagina. This procedure may also be used to differentiate between a vesicovaginal fistula and a ureterovaginal fistula. In the ureterovaginal fistula the colored solution remains in the bladder and does not appear in the vagina.

Cystoscopy is of further value in these cases in determining the exact location of the vesical opening of the fistula and its relation to, or proximity to, one or the other ureteral orifice. If the fistula is located close to one of the ureters so that the ureter is in danger of being injured at the operation, one may fortify himself against such a possibility by catheterizing one or both ureters just prior to the operation

Calcareous cystitis and occasionally bladder stones are found

as complicating conditions revealed by cystoscopic examination. The value of careful and repeated cystoscopic examination in this group of cases is very evident, because, as is well known, severe cystitis, stone, and other intravesical complications are factors contributing to failure of the operation to bring a closure

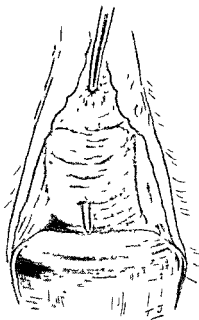


Fig. 341—Demonstration of fistula. A male urethral sound has been introduced into the bladder and the tip of the sound brought out of the fistulous opening in the vagina.

of the fistula. Should the cystoscopic examination reveal intravesical complications it is needless to say that these should be corrected before operative measures are undertaken.

In some instances as a result of the continuous leaking of urine with or without decomposition the vagina and external

The circular incision will now be prolonged upward and downward, so as to allow a free dissection separating the bladder from the vagina. I will continue the dissection so that the bladder can be mobilized. It is important to have the bladder dissection made as extensive as possible so that the sutures can be placed without tension. As you see I can now bring the cut edges of the bladder end of the *titula* into very close apposition and without tension.

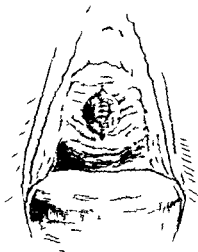


Fig. 344.—Closure of the bladder opening by catgut suture

By means of catgut sutures the opening has been closed (Fig. 344). These sutures pass through the bladder wall up to but not including the bladder mucous membrane. Having closed the opening in the bladder we will now close the vaginal mucous membrane with catgut sewing this in the opposite direction to that in which the bladder mucous membrane was sewed (Fig. 345).

A small pack will be placed in the vagina and an indwelling catheter placed in the bladder.

Postoperative History—The vaginal pack was removed on the third day. The vagina was douched with warm boric solution and another small pack introduced. The bladder was irrigated with a small amount of boric solution. Since operation there has been no leakage of urine and the patient has remained dry ever since.

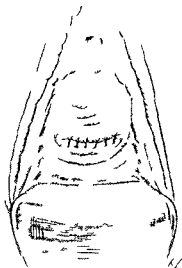


Fig. 345. Closure of the abdominal incision. This is made in a direct line at right angles to that of the bladder opening.

Cystoscopic examination made one week after operation showed no leakage during cystoscopy and a slough at the site of the previous fistulous opening was seen. Another cystoscopic examination made six weeks later showed the bladder completely healed. There was no sign of a fistulous opening or of the slough previously seen. The bladder capacity was 11 ounces. The patient has had no return of the former trouble.

CLINIC OF DR EDWARD LOUIS MOORHEAD

MERCY HOSPITAL

FLOATING KIDNEY

Summary A patient presenting mild symptoms of intestinal obstruction associated with the presence of an abdominal mass diagnosis frequency and pathology of floating kidney symptoms indications for operation technic of nephropexy after treatment

THIS patient aged fifty six years, is married and the mother of one child who is now eighteen years of age. She states that ten days ago she was seized with a severe pain in the right side of the abdomen. She became nauseated and vomited and was unable to obtain a bowel movement. A physician was called and upon examination, he found the abdomen distended and a lump about the size of an adult's fist, a little below the umbilicus and to the right of the median line. He advised operation for the relief of the bowel obstruction as he thought it was due to the presence of an abdominal tumor. Operation was refused and by the administration of olive oil by mouth and the use of enemata a bowel movement was finally secured. The patient remained in bed for a week and by the daily use of cathartics and enemata the bowels have moved slightly each day.

Patient was admitted to the hospital two days ago. There is nothing unusual in her personal history, no special sickness. Never knew that she had any abdominal tumor before the present attack. Always more or less constipated.

Menstruation began when she was thirteen years of age. Menopause occurred at forty-eight years. Menstruation has always been regular and not especially painful. No history of any disturbance of the genito-urinary system.

Physical Examination—Patient is fairly well nourished. Head, neck and thorax negative.

Abdomen—Slightly distended. A definite tumor mass apparently about the size of an adult's fist is found on the right side of the median line and extending below the level of the umbilicus. This tumor mass does not move with respiration. It is not very painful to touch, is but slightly movable, and there is dulness upon percussion, the tumor mass apparently being against the abdominal wall, without the interposition of any bowel.

With this history as given to me, without any previous complaint on the part of the patient, the question naturally arises: What is the nature of this tumor mass and what is its anatomic location? Upon the answer to this question depends the line of procedure to be adopted in treating the case.

The urinary findings are negative. Bimanual examination does not reveal to me that the mass is connected with the uterus, although its position corresponds quite nicely to that of an ovarian cyst, in which the pedicle may have become twisted slightly at the time of the acute attack, or possibly a pedunculated fibroid. There is marked tympany between the mass and the lower border of the liver, and the absence of movement of the mass during respiration probably excludes the gall bladder. The temperature and pulse are practically normal, as is also the leucocyte count and, therefore, I think we can rule out acute appendical inflammation with a resultant abscess formation. Of course, malignancy involving the bowel or retroperitoneal structures must not be lost sight of. This brings us to a consideration of the possibility of the tumor mass being a floating kidney which, as a result of a localized inflammatory process, has become fixed in the position it now occupies. The patient has been examined under the fluoroscope and several x ray plates have been made, after the ingestion of a bismuth meal, with the result that we believe the tumor mass to be the right kidney, which has moved a considerable distance from its normal position and become fixed there as a result of inflammatory adhesions, and is producing interference with the intestinal current.

The normal kidney is not a fixed organ but moves up and down on respiration, although usually this movement cannot be detected on palpation. Clinically, three stages of abnormal

mobility of the kidney may be described first, a palpable kidney is one the lower half or more of which can be definitely felt on deep inspiration, second, a movable kidney is one in which the examining hand can define the upper end of the organ, and can restrain it from returning to its old position during expiration, third, a floating kidney is one which can be moved freely about the abdomen in all directions, and even across the middle line in some cases

Palpable kidney occurs in women in 85 per cent of the cases, in men rarely. The fossa in which the kidney lies is more shallow and wider at its lower part in women than in men. The frequency of movable kidney among women varies greatly according to the statistics of different observers, that is, from 3 to 46 per cent. The majority of cases are observed between the twentieth and fortieth years of life. The condition has been observed in infants and among the aged. The right kidney is movable fifteen times as often as the left. Among women repeated pregnancies with the resulting flabby condition of the abdominal walls are often followed by movable kidney, sometimes alone, sometimes as a part of general enteroptosis. Movable kidney is also frequently found in slender, poorly nourished females of lax fiber, with long thoracic cavities, who have never borne children. Tight lacing has been given as a cause in the production of movable kidney, but it is frequently found among races who never wear constricting clothing about the waist. Violent muscular effort, as in falls, railroad accidents, etc., and blows from blunt objects, such that, if more violent, would produce rupture of the kidney, are direct causes in a number of cases, rapid emaciation with absorption of perinephritic fat is sometimes observed as a cause. Constipation is an important element in the production of movable kidney, and probably acts by the loaded cecum dragging upon the anterior layers of the perinephritic fascia, and thus displacing it forward.

Symptoms—The symptoms produced by movable kidney are quite varied. It is important to bear in mind that in a large number of cases no symptoms occur and frequently the movable kidney is discovered by accident. It follows, therefore, that

every movable kidney does not require operation, but only in cases in which marked symptoms appear is operation indicated. The principal symptoms produced by movable kidney are 1 Pain 2 Digestive disturbances 3 Changes in the urine and disturbances of the urinary apparatus 4 Pressure symptoms on the duodenum and biliary passages, such as dilatation of the stomach, jaundice, appendicitis from congestion of the appendix caused by compression of the superior mesenteric vein between the head of the pancreas and the spinal vertebra by the displaced kidney (Edebohls) 5 Nervous symptoms—neurasthenia and hysteria

Pain—The pain produced by movable kidney varies. In some cases the patient comes under observation because she has observed a movable lump in the abdomen, which in handling is painful, the pain being often associated with nausea and vomiting. In other cases pain and vomiting bring the patient under observation, the doctor discovering the movable kidney. These attacks are sometimes known as "renal paroxysms" or as "Dietl's crises." They occur suddenly, the patient is seized with violent abdominal pain, nausea and vomiting usually follow, the patient may fall into a condition of collapse, with small thready pulse, coldness of the extremities, and clammy sweating. There may be a chill and high temperature. Upon physical examination the kidney is usually found to be palpably enlarged and quite tender to touch. If the condition has been one simply of kinking of the ureter subsidence of the pain will be followed by a transient polyuria—the condition has been one of acute hydronephrosis. Frequently, however the attack is caused by torsion of all the structures of the pedicle, producing thereby an intense venous congestion of the kidney and greatly increased intracapsular pressure.

former group —

kidney no such severe attacks occur the patient may suffer from moderately severe attacks of pain in the loin, in the sacral region, from neuralgic pains radiating into the lower extremities, from a sense of dragging and weight in the abdomen and back, made

worse by the erect posture and by exercise. Such sensations may be more or less constant while the patient is up and about but usually subside after lying in bed for some hours. During menstruation the pain is worse and this condition often appears to be a determining factor in the production of an unusually severe attack.

Digestive Disturbances—Nausea and vomiting usually occur either with the attacks of pain or independently of them. Constipation is the rule occasionally however diarrhoea occurs.

Changes in the Urine—The urine remains normal in most cases of movable kidney. transient albuminuria or even the presence of a small amount of blood in the urine may appear during or following an attack. Frequent and painful urination are quite common. Polyuria is often observed at the end of an attack. Oliguria, anuria and symptoms of uremia have been observed. Repeated attacks may lead to gradual dilatation of the renal pelvis and chronic hydronephrosis.

Pressure Symptoms—Movable kidney may by traction cause partial constriction of the duodenum gastric dilatation and probably obstruction of the common bile duct. Previous mention has been made of the mechanism whereby the congestion of the vermiform appendix and a predisposition to appendicitis may occur.

Nervous Symptoms—One of the most common accompaniments of those cases of movable kidney presenting symptoms is a condition of neurasthenia more or less profound often associated with hysteria. In some of these cases fixation of the kidney by operation gives relief from these nervous symptoms but many patients remain as neurasthenic as before. If the patient was neurasthenic previous to the appearance of symptoms referable to the kidney operation will not be productive of much benefit. Many of these patients are apt to acquire the surgical operation habit and go from one operator to another having the kidney fixed the appendix the ovaries and even the uterus removed and in the end are no better and may subsequently have several more operations for postoperative adhesions ventral hernia etc.

Floating kidney itself is rarely mistaken but many other conditions have been taken for it. Distended gall bladders, fecal masses in the colon, omental cysts, tumors of the pancreas, carcinoma of the pylorus, ovarian cysts, floating spleen and many others have been diagnosed as such and in some instances the mistake was not apparent until the abdomen had been opened. Even when the tumor is superficial it is easy to be misled by a vague resemblance in shape, when it is deep and scarcely movable there may be nothing but the peculiar character of the renal pain to serve as a guide.

Considering all these manifestations associated with the condition of movable kidney, what can be said as to the indications for operation? The following indications are, I believe, fairly safe guides: 1. Extreme mobility, so that the organ cannot be fixed by a support. 2. Extreme tenderness so that a support cannot be tolerated. 3. The recurrence of acute attacks of pain and vomiting (Dietl's crises). 4. Persistent discomfort in the loin combined with digestive disturbances, vomiting and a great variety of neurasthenic manifestations, as a rule a kidney sufficiently mobile to produce such symptoms is tender to the touch, and examination causes pain and nausea. 5. The super-vention of hydronephrosis or pyelitis. 6. Cases in which the kidney has become fixed in an abnormal position as a result of inflammatory adhesions and producing obstructive symptoms as illustrated in this present case.

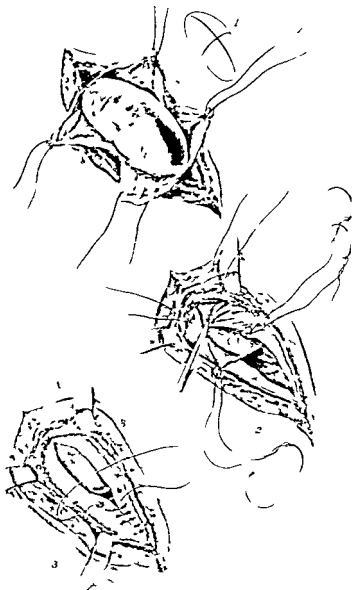
Nephrorrhaphy or nephropexy is the name applied to the operation for suspending or fixing the kidney. The aim of the operation is to re-establish the kidney in as near its anatomic position as possible so that with the healing of the wound the resulting adhesions and scar tissue will maintain the new support.

Operation.—The kidney may be exposed by either the vertical transverse or lumbar oblique incision. In the present case I will make use of the oblique lumbar incision as I believe it to be the best. Beginning at the outer edge of the erector spinae on a level with the twelfth rib the incision about 4 inches in length, is carried downward and forward to a point a finger breadth above the highest point of the iliac crest. The incision

is deepened through the first muscle plane *latissimus dorsi* above and external oblique below then through the second muscle plane of internal oblique. The aponeurosis of the transversalis and its muscle fibers toward the anterior end of the wound are next incised from a point slightly below the upper end of the wound. The extension of the wound at this end may more carefully be accomplished by inserting the finger beneath the aponeurosis and carrying the incision upward over the guiding finger thus avoiding a blind incision with possible injury to the pleura. The iliohypogastric and ilio inguinal nerves are now held by the retractor with the posterior sectioned muscles and the twelfth intercostal with the anterior. The transversalis fascia is now incised and the perirenal fat lies exposed in the wound. It is well to remember to incise this fascia first in the posterior part of the wound and then to prolong the incision with the finger beneath as a guide. By following this procedure the danger of opening the peritoneum may be avoided.

The perirenal fat is now torn through and the upper pole of the kidney is exposed. The kidney lies at the lower part of the wound and toward the median line anteriorly. A careful separation of the remainder of the fatty capsule and the adhesions holding the kidney must be made before the kidney can be delivered into the wound. Having delivered the kidney careful examination is now made for possible stone or any abnormality before proceeding further with the operation. The kidney is normal in size and there is no apparent pathologic change present consequently we will proceed with the nephrorrhaphy. There are many methods of doing this from the older way of leaving the wound down to the kidney open and packing with gauze so that healing occurs by granulation to the various methods of placing sutures through the kidney substance or utilizing its fibrous capsule in different ways to suspend the organ.

The method which I usually follow and will use in this case is similar to the operation described by Edebohl and Albarran with some slight modifications. The fibrous capsule is incised on a grooved director along the convex border of the organ. By blunt dissection with the handle of the scalpel or the finger the



capsule is stripped back on either side in two flaps for a distance of $\frac{3}{4}$ inch. This exposes the parenchyma from which there is a little oozing. This oozing is readily controlled by pressure with a gauze sponge. The fibrous capsule on either side is now cut through the middle making of it four flaps, an upper and lower on each side (Fig. 346 1A). The gathered end of each flap is now caught with a chromic catgut ligature, the ends of which are left long (Fig. 346 1). The ligature of the upper anterior flap is now threaded on a needle which is passed through the fascial layers at the upper angle of the wound; the other half of the ligature is now threaded on the needle and passed through the fascial layers about $\frac{3}{8}$ inch from its other half. The same procedure is now carried out with the upper posterior flap ligature (Fig. 346 2). The two upper flap ligatures are now tied by my assistant while I hold the kidney in its new position. This brings the kidney up under the ribs to about one third its extent. The ligatures of the two lower flaps are now threaded on the needle and the same procedure followed as was done with the upper flap ligatures. The wound will now be closed in layers with chromic catgut sutures (Fig. 346 3); the transversalis fascia first, the aponeurosis and muscular layers next and finally the skin with interrupted silkworm gut sutures. A large dressing is placed over the wound and a pad on the anterior abdominal side to aid in the support of the kidney and a well fitting abdominal bandage applied. The patient will be put to bed with the foot of the bed slightly elevated and a soft pillow will be placed beneath the scapula and buttock of the right side. This will keep pressure from the wound and the position with the foot of the bed elevated will tend to obviate any possible tension on the suspending sutures. This position will be maintained with a little relaxation for about three weeks after which the

Fig. 346 11 Line of incision of fibrous capsule of kidney. 1 Kidney delivered, flaps made and sutures inserted in flaps. Suture on lowermost flap in position but not tied. 2 Sutures of two upper flaps passed through the transversalis fascia and muscle plane. Lower sutures threaded ready to pass through muscle plane and fascia. 3A Upper suspension sutures tied and cut. 3B Lower suspension sutures. Transversalis fascia being closed by continuous chromic gut suture.

patient will be allowed to sit up a little at a time for another week, giving at least one month before the patient is up and about

During convalescence the patient should be fed on a diet that will tend to increase the intra abdominal and perirenal fat, so that the support of these may be gained as an accessory to the operative suspension. These patients, as a rule, are more or less debilitated, and should be given plenty of time to recuperate before attempting to move about very much

OLD UNTREATED FRACTURE OF EXTERNAL CONDYLE OF HUMERUS—FACTORS INFLUENCING CHOICE OF TREATMENT

THIS man is twenty two years of age. He comes to us with the history of having received an injury to his right elbow when he was five years of age. He states that the injury was produced by a fall upon the elbow and was considered as a dislocation and treated as such. A few weeks following the injury he says that a man was lifting him by the hands and the dislocation recurred and was treated as before. From all we can learn from the patient there was not much made of the injury nor a great deal of care given to it. His surroundings were very poor and no doubt he received scant medical attention. The boy grew up to manhood without anything further being done for him. He says that he played baseball and took part in other sports but when he exercised upon the horizontal bars his elbow would sometimes pain him a little. Last summer during his vacation he was employed as a freight handler in one of the local freight houses and he says that he was able to perform his duties very well.

From the history given by the patient there is apparently a good functional result following the injury but he wants to know if something more can be done for him. Upon examination the arm and forearm are found to correspond in size both as to length and development with its opposite fellow. The angle of the forearm to the arm has not been appreciably changed. Supination is not interfered with but pronation is to a moderate degree. Flexion and extension are very good in fact almost complete. At the outer side of the elbow joint and on the anterior surface there is an enlargement about $1\frac{1}{2} \times 1$ inches which moves when the forearm is flexed and extended. It gives to the examining hand a sensation resembling that produced by the ends of bones rubbing together. When the forearm is flexed

there is apparently a separation between this enlargement and the head of the radius, but this is not so distinct when the forearm is extended. The radial head seems to be attached to the enlargement. When the radius is rotated the enlargement does not move, but remains stationary.

As a result of the examination a probable diagnosis of fracture with displacement of the external condyle of the humerus is



Fig. 347—x Ray of elbow seventeen years after injury. Note that entire external condyle has been separated from the humerus carrying with it the radial articulation.

made the good functional result in a case of so many years standing, is not unusual. Mr. J. B. Zingrone, our radiologist, has made some beautiful stereo x ray plates of this case and by examining them you can see the true condition of the joint. There is no question regarding the condition after looking at these x ray plates. The external condyle of the humerus has been fractured and displaced, carrying with it the radial head articulation. The condyle is attached to the humerus in some

was by fibrous tissue, which allows of certain movements of the condyle and at the same time does not interfere greatly with the function of the joint (Fig. 347).

While passing on this case I wish to impress upon you the great value of roentgen ray plates in all joint injuries. The information gained by this method of examination is far surpasses the value plate that I am sure if you once use this method you will be convinced of its superiority.

What to do for this young man is a question. Of course if this were a recent case and the displaced fragment of bone could not be retained in proper position by flexion of the forearm and the application of an angular cast then an open operation would be indicated and the displaced fragment of bone secured in position by wire screw or nail. But according to the history this injury is now of fifteen years standing and the functional result is good, there is no pain or discomfort and practically no inconvenience to the patient. His occupation (theological student) will not require any very violent manual labor hence he is not in a very bad way. On the other hand the operative risk that he would take especially in regard to the movement of the joint has been explained to him that he may make his own choice whether to continue as he has or have the bone replaced and need no operation. The case looks quite simple and under ordinary conditions there should be no great difficulty in performing the operation and obtaining a good result but I would warn you that previous to proceeding with your operative measures in a case of this kind standing with such a good functional result to explain to the patient the possibilities that must occur and let him decide for himself.

there is apparently a separation between this enlargement and the head of the radius but this is not so distinct when the forearm is extended. The radial head seems to be attached to the enlargement. When the radius is rotated the enlargement does not move but remains stationary.

As a result of the examination a probable diagnosis of fracture with displacement of the external condyle of the humerus is



Fig. 34. X Ray of elbow seen ten years after injury. Note that entire external condyle has been separated from the humerus carrying with it the radial articulation.

made the good functional result in a case of so many years standing is not unusual. Mr. J. B. Zingrone, our radiologist, has made some beautiful stereo-ray plates of this case and by examining them you can see the true condition of the joint. There is no question regarding the condition after looking at these ray plates. The external condyle of the humerus has been fractured and displaced carrying with it the radial head articulation. The condyle is attached to the humerus in some

way by fibrous tissue which allows of certain movements of the condyle and at the same time does not interfere greatly with the function of the joint (Fig 347)

While speaking of this case I wish to impress upon you the great value of stereo ray plates in all joint injuries. The information gained by this method of examination so far surpasses the single plate that I am sure if you once use this method you will be convinced of its superiority.

What to do for this young man is a question. Of course if this were a recent case and the displaced fragment of bone could not be retained in proper position by flexion of the forearm and the application of an angular splint then an open operation would be indicated and the displaced fragment of bone secured in position by wire screw or nail. But according to the history this injury is now of seventeen years standing and the functional result is good, there is no pain or discomfort and practically no inconvenience to the patient. His occupation (theological student) will not require any very violent manual labor hence he is not in a very bad way. On the other hand the operative risk that he would take especially in regard to the movements of the joint have been explained to him that he may make his own choice whether to continue as he has or have the bone replaced and fixed by operation. The case looks quite simple and under ordinary conditions there should be no great difficulty in performing the operation and obtaining a good result but I would warn you that previous to proceeding with your operative measures in a case of this long standing with such a good functional result to explain to the patient the possibilities that might occur and let him decide for himself.

there is apparently a separation between this enlargement and the head of the radius but this is not so distinct when the forearm is extended. The radial head seems to be attached to this enlargement. When the radius is rotated the enlargement does not move but remains stationary.

As a result of the examination a probable diagnosis of fracture with displacement of the external condyle of the humerus.



Fig 34 —x Ray of elbow seventeen years after fracture external condyle has been separated from the humerus the radial articular surface.

made the good functional result in a case standing is not unusual. Mr J B Zingro has made some beautiful stereo x ray plates examining them you can see the true condition. There is no question regarding the condition these x ray plates. The external condyle has been fractured and displaced carrying with it the articular surface. The condyle is in contact with the articular surface.

GREENSTICK FRACTURE OF TIBIA

This school boy, aged thirteen years while engaged in playing a game of baseball, attempted to steal second base and in making his jump for a slide he says that his spikes became caught in some manner and his right leg was given a severe twist. He suffered a great deal of pain and did not attempt to arise or stand upon the injured limb. The trainer in charge of the boys immediately applied a bandage to the injured limb and the patient was transported to the hospital. An examination was made of the limb at this time and it revealed no apparent deformity but upon very gentle manipulation crepitus could be determined. In view of the fact that there was no apparent deformity no further manipulation was allowed but the patient was sent to the *x ray* department in order that *x ray* plates might be made at once. The *x-ray* plates show very clearly the nature of the injury—evidently a greenstick fracture of the tibia without displacement. The fibula is not fractured and there is no apparent deformity (Figs 348, *a* and 348 *b*)

This fracture of the tibia was produced no doubt by the twisting of the limb the lower part of the limb being firmly fixed by the spikes of the shoe having been driven into the ground and the body acting as a lever. In cases such as this without deformity it is not good policy to manipulate the limb to determine the site of fracture if any but rather have an *x ray* plate made at once and be guided by it.

It is quite evident that considerable damage could be done in a case of this kind by manipulation. The sharp points at the lower or upper end of the fracture could very easily be made to pierce the soft parts thereby changing the simple into a compound fracture.

In the treatment all that is necessary is the application of some form of a light retentive dressing merely to overcome movements. The various forms of metallic splints conforming

to the shape of the limb may be used or a well padded wooden splint. Personally I favor the use of a light plaster-of Paris cast,



Fig. 4 — Anteroposterior x-ray picture of leg showing greenstick fracture of tibia.

that is the form of dressing that will be applied in this case. Applying a plaster-of Paris cast be sure that it is well and evenly padded and that there is no undue pressure made on any

point. Never apply a cast too tightly. If there is any question in your mind that the cast is too tight, split it through the center and afterward hold it in place by a bandage. This patient will wear the cast for three weeks, after which time he will be allowed

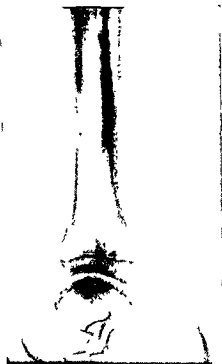


Fig. 348, b —Lateral x ray picture of leg, showing greenstick fracture of tibia

to use the limb, with the aid of crutches. In a short time, as soon as the patient feels sure of the limb carrying the body weight, the crutches will be discarded, and a cane or walking stick substituted if necessary.

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CLINIC OF DR EDWARD H OCHSNER

AUGUSTANA HOSPITAL

TECHNIC OF ABDOMINAL SECTION

Summary Laparotomy for adnexal disease preparation of field of operation scrubbing with soap and water followed by alcohol the best method as a rule abdominal exploration removal of left adnexa temporary ventrosuspension of the uterus closure of abdominal incision

April 23, 1919

THE patient is a female thirty six years old her mother died with cancer otherwise the family history is negative On various occasions during the past three years she has had slight pain in the right side about the region of McBurney's point, and just one month ago she complained of very severe pain in the left lower quadrant of the abdomen Up to three months ago the menstruations have been normal and painless but during the last three periods she has had extreme pain in the left side and the flow has persisted for seven days instead of four days as previously On examination one month ago, shortly after her menstrual period the left tube was distinctly palpable and very tender Two weeks later the tenderness had almost entirely subsided but during the last menstruation the pain was again severe and since then the tenderness and pain have persisted

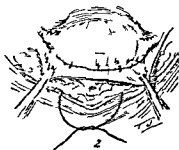
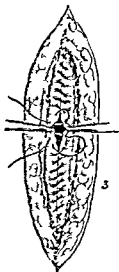
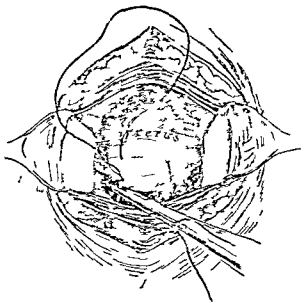
Physical Examination—The patient is a rather nervous, fairly well nourished slightly anemic woman, heart and lungs normal abdomen scaphoid slight tenderness over McBurney's point more tenderness in left inguinal region The perineum is intact the cervix also the uterus is far down in the pelvis, the right adnexa are palpable and not tender The uterus is drawn slightly to the left and is immovable The left adnexa consist of a firm egg sized, immovable tender mass

Operation.—You observe that, except for the shaving which was done yesterday evening we prepare the patient on the table immediately preceding the operation. We scrub the abdomen carefully with sterile soap and sterile water and finally with 95 per cent alcohol. After many years I have found this method to be by far the best. The great danger in preparing the patient the night before is that the irritation from the shaving and anti-septic used will cause a slight itching and the patient during the hours of sleep is apt unconsciously to get her hand under the dressing and thus contaminate the field of operation. The following morning the surgeon begins his operation with a false feeling of security. If the preparation of the patient is made on the table directly before the operation under the supervision of the surgeon this danger is avoided and antiseptics are entirely unnecessary and I think even harmful because they cause skin irritation and because they are apt to divert the attention from an essential to a non-essential. That antiseptics are undesirable and unnecessary I have proved to my own satisfaction. From January 1 1908 to July 1 1910 a period of thirty months I made accurate observations on every clean operation that I performed and during that period I had only two stitch infections. One was in a right rectus incision for gall bladder and appendix in which a spurger struck my glass and a drop fell back into the wound. This wound was slightly infected but was entirely healed within two weeks. Another in a McBurney's incision for recurrent appendicitis in which by some error in technic one of the catgut stitches became infected and from which there was a discharge in the course of a few days of not to exceed 2 dram. These were absolutely the only infected clean wounds that occurred in a period of thirty months and that without the use of a single antiseptic certainly a record that it would be difficult to duplicate where antiseptics are used. I firmly believe that antiseptics are not only useless but actually harmful because they result in misplaced confidence and if one's attention is centered on a non-essential it is likely to be distracted from the essential.

We now make a low median incision picking up the per-

toneum with great care so as not to injure the intra abdominal organs I pass my right hand up under the liver and carefully examine the gall bladder It is moderately filled, but collapsible, and contains no palpable stones I now draw the cecum up and make a careful examination of the appendix It is found with difficulty because it is completely embedded in old adhesions These we loosen, I remove the appendix, and bury the stump in the ordinary manner, being very careful to leave a smooth surface We now lower the head of the table, pack the small intestine, cecum, and omentum away from the field of operation with a large dry sterile gauze pad, then carefully examine the right tube and ovary, which are normal The ovary contains a large false corpus luteum, which we do not disturb The left adnexa are embedded in a mass of adhesions, to the right we find the uterus, posteriorly the sigmoid, which, with the tube and ovary, make a mass about the size of a small lemon We find the point of cleavage, clamp the tube and broad ligament on the mesial side from the mass, and the broad ligament on the lateral side, and remove the mass, consisting of inflamed ovary and tube, ligate the stumps, then bring the two stumps together with an unchromicized catgut stitch in order that the opportunity for adhesions may be reduced to the minimum We place the sigmoid in its natural position and observe the position of the uterus, which we find drops back into the pelvis

For the past seventeen years I have used an operation in this class of cases to prevent the uterus from falling back into the pelvis, becoming adherent in this position, and making a plug to the pelvic outlet I called the operation "temporary ventrosuspension of the uterus," and it is performed in the following manner A strong cervix needle armed with unchromicized catgut is introduced through the rectus fascia on the left side about one inch below the lower angle of the peritoneal wound, passed through the rectus muscle, and then through the peritoneum Then a good bite is taken of the uterus a little behind the top of the fundus of the uterus, and the needle is brought out in the reverse order on the right side, and the stitch tied just tight enough to hold the uterus in apposition to the



uninjured parietal peritoneum The sigmoid is now brought around behind the uterus in its normal curve, all the abraded surfaces covered with omentum In the past seventeen years I have used this method in all my cases of pelvic infection in which the uterus showed a tendency to fall back in the pelvis, have followed most of my cases carefully, and have found that this is an effective method of preventing postoperative retro flexion with its concomitant constipation and digestive disturbances (Fig 349, 1 2)

Now that the peritoneal toilet is completed, we will proceed to close the abdominal wound First we use silkworm gut stitches in the ordinary manner, passing them through skin, fascia, and muscle We then close the peritoneum but here we make a slight variation from the usual method, namely, we close it in from both angles ending the closure at about the center *Then after removing the last abdominal pad we raise the peritoneum with these hemostats and tie the two catgut stitches together while the peritoneum is thus raised (Fig 349, 3)* By following this procedure I am sure we are able to very materially reduce the percentage of cases which subsequently suffered from adhesions I have now used this method for something like fifteen years, and during that time have been surprised by the rarity with which patients complain of intra-abdominal pain even after the most extensive operations We now close the fascia from both angles in the same manner This, I believe, is a precaution worth taking and one which materially reduces the percentage of postoperative hernias because by beginning at the angles one is sure to catch the fascia with the first stitch while if one ends at one angle this is not always so easily accomplished, particularly in very obese patients We now close the skin wound with horse hair stitches, securing careful coaptation, and then tie the silkworm gut stitches loosely The silkworm gut stitches are employed simply as a matter of

Fig 349—1 2 Temporary ventrosuspension of uterus ' by a single stitch of chromicized catgut 3 Closure of peritoneum the suturing is begun at each angle and terminates at the middle of the incision permitting eversion of the peritoneal flaps

insurance to protect the patient from the calamity of having the abdominal wound split open anywhere between the fourth and tenth day, and are left in place for thirteen days even if the patient is permitted to get up before that time

Catgut prepared even by the same firm often varies greatly in the number of days it takes to become absorbed, and I now know of a considerable number of patients in the hands of a number of operators in whom the abdominal wound split open, either because no silkworm gut stitches were employed or because they were removed too soon. This unfortunate accident can be avoided in practically every case if the silkworm gut stitches are used, tied loosely, so as not to shut off the blood supply, and if they are left in a sufficient length of time

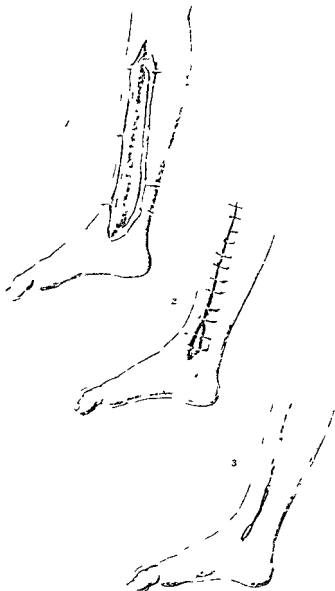
OLD OSTEOMYELITIS OF THE TIBIA

Sum

This case a boy sixteen years of age, came to us on March 11 1919 with a history that about three years ago he had a number of boils on his neck. Last summer he had two on his arm. September 1918 after playing football he experienced pain in the ankle. This was followed in a couple of days by chills and pyrexia up to 104° F. Ankle and lower portion of leg were markedly swollen red painful and tender. This was incised and considerable pus discharged. Three weeks later he was operated under an anesthetic and the bone scraped.

On admission to the hospital March 11 1919 the patient was poorly nourished the face was covered with acne and there was numbness and weakness of right arm apparently due to long continued use of crutches. Heart lungs and abdomen negative. Right lower extremity from the knee down considerably atrophied with swelling of the ankle and the foot at rest held at an angle of 105 degrees. Dorsal flexion both active and passive about 5 degrees extension about 10 degrees both causing some pain. On the anterior surface of the shin from 2 inches below the anterior spine of the tibia to the ankle was a linear depressed reddened inflamed scar with numerous sinuses discharging pus. From the lowermost one there was projecting a piece of gauze which on removal left a cavity about 2 inches deep.

After applying an Esmarch we opened the old scar the full length and reflected skin and periosteum on either side being careful not to separate the skin from the periosteum. We opened into the marrow space of the tibia from one end of the infected area to the other removed a number of sequestra, then chiseled away as much of the sides of the trough as seemed safe without running the risk of getting a fracture of



Foot

Fig 30

the tibia (Fig 350, 1) At the lower half it appeared to be unsafe to remove much of these sides because the posterior surface of the tibia had necrosed through to the periosteum Skin and periosteal flaps were now made to cover the denuded tibia loosely by infolding (Fig 350, 2) The lower half of the wound where the skin and periosteal flaps were not sufficient to cover was packed lightly with sterile gauze Dry dressing applied

Postoperative History—Moderate bloody discharge persisted for the first twenty four hours without much pain or pyrexia Two days after operation the wound was redressed in the same manner On the fourth day after operation the wound was again dressed, the pussy discharge was quite profuse, greenish in color, with the characteristic pyocyanous odor The wound was cleaned, the cavity filled with 1 per cent acetic acid in normal salt solution, as advised by Taylor for the treatment of pyocyanous infection, and then packed with gauze saturated in this same solution Dry dressing applied This dressing was continued daily for ten days After the very first dressing the green pus became very much less in quantity and at the end of ten days no further trace of it was visible The wound was at that time covered by strong, healthy, red, firm granulations The silkworm gut stitches were removed and the upper half of the wound was, with the exception of one pea sized spot, completely healed The lower portion of the wound was now filled with sterile Unna's paint at 45° C or 113° F Since that time the patient has been placed in a full bath at 93° F every second morning and the cavity filled with Unna's paint covered with a dry dressing, and the defect has filled in with surprising rapidity Figure 350, 1 shows the appearance of the leg at the end of the operation Figure 350, 3 shows the appearance of the leg forty three days after the operation or twenty nine days after the beginning of the use of Unna's paint

Fig 350—1 All necrotic tissue and exuberant granulations removed and the bone cavity converted into a wide gutter 2 Soft tissues carried into gutter by mattress sutures thus obliterating all but the lower portion of the cavity here the soft tissues are too scant to cover the osseous defect 3, Result after twelve weeks

I have found this method of treating osteomyelitis of the long bones much more satisfactory than any other, even including the Moorhof wax plug. It is truly surprising to see with what rapidity these wounds fill in and heal out completely. There are only two precautions necessary. One is that properly made Unna's paint be used, and the other that it be employed at the right temperature. The temperature sense of the surgeon is scarcely sufficient in determining the proper temperature of the melted mixture. The temperature must actually be regulated by a dependable thermometer and should be about 45°C . Unna's paint should be made in the following manner:

Take a double boiler (ordinary oatmeal boiler), fill the outer basin one third full of ordinary water, then place 10 ounces of sterile water in the inner boiler and 4 ounces of ordinary grocer's sheet gelatin. Place inner receptacle in outer receptacle and put over a slow fire, leaving it on until gelatin is dissolved, then add 10 ounces of glycerin, and then 4 ounces of zinc oxid gradually, constantly stirring.

When completed, Unna's paint is placed in a sterile Mason jar, thus set in some cold water on some gauze or a towel, the water nearly up to the rim of the Mason jar, with the cover placed loosely over the top of the jar, and boiled for an hour, thus sterilizing the mixture.

Whenever Unna's paint is required place the Mason jar in some cold water on a piece of gauze and heat until dissolved. Pour some in a sterile cup, test the temperature and when 45°C , fill the cavity with the preparation. Then apply a dry dressing. In two days have the patient take a tub-bath at 93°F for fifteen minutes then re apply the dressing and change it at forty-eight-hour intervals until the wound has healed.

On looking at the illustrations it will be observed that the foot is held at an angle of about 105° degrees to the leg. It was in this position when the patient first came under my care, with very little motion possible at the ankle. So much of the lower end of the shaft of the tibia had to be sacrificed that it was impossible to bring the foot to less than a right angle without risk of fracturing the tibia. Consequently no effort was made at

that time to correct the deformity. In acute osteomyelitis of the shafts of long bones great effort should be made to prevent faulty positions of the nearest joints. Because drop-ankle was not prevented in this case it may be necessary to anesthetize this patient again in order to correct this deformity.

There is still another criticism which I wish to make in the previous treatment of this case, namely, that the second operation was done too soon after the onset of the disease. While the first incision of the periosteum with a possible opening into the medullary canal should be done just as soon as a diagnosis is made, the secondary operation should never be performed until one is convinced that the sequestrum has entirely loosened and the involucrum has become strong enough to prevent pathologic fracture. In an acute osteomyelitis of the tibia at least two months should intervene between the onset of the disease and the sequestrotomy.

Postscript—The wound became completely healed on June 3d, exactly twelve weeks after the day of the last operation, with the deepest point in the trough only $\frac{1}{8}$ inch below the level of the surrounding tissues.

CLINIC OF DR KELLOGG SPEED

COOK COUNTY HOSPITAL

ELEMENTARY AND APPLIED PHYSICS OF BONE

Summary Mechanical factors which influence the behavior of bone from the standpoint of its physical structure the relation of local trauma and systemic disease and the application of Wolff's law the physics of fractures

To practice surgery correctly, particularly in those branches dealing with bone structure, we must have an elementary knowledge of osseous structure from a purely physical standpoint. Bone, although in a physical sense the hardest structure in the human body, must not be considered an inert and completely rigid framework on which the organs and tissues are draped. It possesses properties of elasticity and toughness which are essential to its contour and which resist stress and strain. Bone structure is consequently governed by the same physical laws as other elastic substances subjected to stress and strain. Let us then consider bone from the physical standpoint, and we may profit by dividing this subject into the following headings:

- 1 The physical structure of bone
- 2 The relation of the pathologic changes affecting the physical structure, as found in local trauma, such as fracture, and in systemic disease
- 3 A discussion of Wolff's law
- 4 The application of these points to the general mechanism of the commonest lesion of bone, which is fracture

1 *The Physical Structure of Bone*—As an illustration of the physical structure of bone and its adaptation to natural needs, let us take the calcaneus. The heel bone acts as a weight breaker between the body and the ground, and also it is the

anchor into which is inserted for leverage action the powerful group of calf muscles. It is very accessible and its size permits a complete study of its physical architecture, deductions from which can be applied to all bones.

The construction system of this bone has been well understood since 1903, when its great strength was found to depend upon two trabecular or truss systems (Fig 351). One of these systems converges toward the center of the bone and acts as a truss which bears the force offered by compression violence, such as in weight bearing. The other trabecular system arches across the long axis of the bone from front backward and acts as a truss which resists the pull of the plantar and calf muscles.

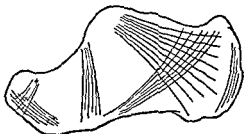


Fig 351 —The trabecular system of the os calcis, showing truss rod supports by means of which the bone adapts itself to both compression and tensile forces.

The calcaneus we know must bear enormous strain and compression. It has been demonstrated that it requires a force varying from 150 to 950 kilograms to crush this bone and that to cause a cracking break through the body frequently requires a force of from 50 to 200 kilograms. If the calcaneus withstands the numerous strains incident to human life its physical architecture must be worth studying because it is undoubtedly influenced by static conditions of stress and strain. We know that this bone anatomically is a spongy bone with truss-like trabeculae crossing at the different angles which I have mentioned. The covering of the bone is an extremely thin shell of compact tissue, and therefore it is this spongy property which

preserves the bone from crushing in the compression sustained in falls and the avulsion force of muscular action. Experimental and clinical observation lead us to the firm conclusion that the spongy structure of bone is more elastic and is intended to take up compression and tensile strains, and that the compacta, on the other hand, which figures largely in the shape and strength of the pipe stem, or long bones, is intended to give rigidity and form. The cancellous ends of the long bones regardless of their apparently delicate structure will resist enormous pressures if these pressures are applied in the normal direction of the body weight or muscle pull.

These elementary physical points in osseous structure are well worth considering when we study fractures or traumatic bone lesions. We frequently consider that the shaft of a long bone, such as the tibia is its strongest portion, but fracture study leads us rather to conclude that the cancellous ends of bones are stronger and offer greater resistance than pipe stem bones with a heavy compacta.

2 *Certain Changes Occurring in Bones Following Local Trauma or Accompanying Systemic Conditions Which Have a Bearing on Osseous Structure*—A qualitative analysis of bone from a physical standpoint demonstrates that its properties of hardness and rigidity are furnished by calcium phosphate, carbonate and fluorid, with the addition of some magnesium phosphate, and that practically 66 per cent. of the total weight of adult bone is composed of these salts. The bones of adolescents contain a smaller percentage of these salts, senile bones a greater percentage.

Roentgen ray study of bone structure has given us some knowledge of the relative salt content of bones and its variation under given conditions. We have come to learn that there exists in human bones a condition of *calcium equilibrium* or balance, much as there exists a protein equilibrium in other tissues of the body. It is understood that there is a continuous flow of calcium salts to and from bones, most of the variation in this flow depending on the calcium supplied by food intake and on the general body metabolic processes. This mechanism is so intricate that

it is as yet not completely understood, but under ordinary food and metabolic conditions the supply of these salts is sufficient to meet all demands. However, when the diet is deprived of calcium salts which it needs, there is an absorption of these same salts from the bones. This loss first affects bones which can spare calcium best without dangerously diminishing their tensile strength, namely, the ribs, skull, and sternum. The amount of ingested calcium is not necessarily a measure of that used in physiologic bone reconstruction, because other tissues of the body demand these salts. In diseased conditions such as rickets and osteomalacia there is probably a *diversion* of the calcium salts to other structures of the body or an increase in their excretion through normal channels. We also know that there exists a *perversion* of the use of calcium salts, particularly in diseases of the pituitary body and in congenital absence of the thyroid or thymus, which leads to bony defects, enlargements, and perverted bone growths.

Bone, moreover, is a living and growing tissue and must, as all such tissues are, be subjected to changes in size and shape from time to time. It is built up and torn down, much as skin and other tissues which are constantly undergoing growth, use, and repair. Its rigidity must vary from time to time and it is consequently shaped by the stress and strain it is subjected to, as well as the forces of local metabolism and trauma just the same as are the soft tissues of the body.

To apply these facts to surgery we must consider then that the rigidity and physical structure of bone is disturbed when its normal physiologic activities are interfered with. As an example, let us take injuries which interfere with the all important blood supply of the bone, then these physiologic functions may be interrupted temporarily as much or more than they are in systemic disease. There is, however, no doubt that a proportion of these earthly salts in the bone matrix is a true indication of the life and activity of the bone—that is, both of its age and its condition of health. When a bone is diseased or injured or in any way deprived of its normal function of stress and strain from weight bearing and muscular action, atrophy develops

within it. In muscle we are familiar with a similar phenomenon namely, atrophy of disuse, which leads to a smaller muscle belly, usually capable of coming back to normal size and strength when placed again under normal physiologic conditions. The proportion of salts in this injured or diseased location is disturbed and the first evidence of this disturbance is found in the character of the shadow cast on a plate by the Roentgen ray. We know that these salt elements throw a shadow on the x ray plate in proportion to their atomic weight. Calcium, which has an atomic weight of 40, makes a denser shadow than magnesium with a weight of 24, and because the latter metal represents but a small proportion of the earthy salts in bone, the main role in the shadow density on the x -ray plate is played by the calcium salts. The truth of this statement is found in the fact that recent callus casts no shadow because no calcifying salts have been deposited. When a bone is fractured or seriously injured we expect at least, a local disturbance of calcium equilibrium. It is found at the site of the trauma partly on account of the circulatory interference and partly because the new growth of bone needed to repair the defect caused by the fracture depends on the preliminary outgrowth of the capillary vessels. This capillary outgrowth must be preceded by a softening of the bone, and we find, therefore, a withdrawal of the stiffening calcium content locally, which is easily demonstrated by a roentgenogram.

3 *A Discussion of Wolff's Law*—Some of these ideas concerning the physical structure of bone have been expressed as Wolff's law which is as follows: "The structure of bone is determined by the internal reaction of the individual bone to the body weight and to the stress and strain of muscular activity." These forces govern its structure and shape. This law may be applied widely in bone traumata and diseases. It governs the formation of a large, firm mass of involucrum about a weaker sequestrum of osteomyelitic bone. The new disposition of bone trabeculae and the laying down of calcium salts becomes very heavy and strong enough to build up the resistance about the weaker pieces of diseased bone and to assure the limb or part of its necessary

physical support. That point in protective bone development has to go back to the law that the shape of bone is determined by the conditions of body weight and stress. Bone weakened by infectious processes must be strengthened to bear weight else it will fracture. We know that fractures do occur under these conditions, but we also know of the enormous effort put forth by nature to avoid these pathologic breaks in the building up of this necessary strengthening structure. The law governs also the changes which follow deformities of the bone after fracture. Many years after angular deformities occur and heal following shaft fractures we find them modified and repaired by the deposition of a new calcium matrix on the concave side of the angulations. The excess portion of callus on the convex side of the healed deformity is gradually absorbed until a new straight line is developed in the bone which meets the physiologic demands of weight bearing and muscular stress. We must, therefore, attempt to replace fractures in a position nearly normal in regard to the functional activity of the bone involved, on account not only of well accepted reasons such as avoidance of deformity or to obtain equal length of the limbs but also because we must consider that this nearly normal reposition involves less local reaction within the bone structure, inasmuch as it does not have to meet changed conditions of weight bearing and muscular stress. If a malposition becomes united, we see that the local plastic building up and tearing down of callus continues until nature has established an axial replacement of the bone concerned which meets the physical requirements. This change may demand years of time to fulfil. Also we must consider that bone must thoroughly calcify and cement in position before it is subjected to strains and functional use which it cannot sustain. Should this precaution not be taken, we see secondary deformities. A weak callus gives a bending deformity and a functional loss. A thickened callus means an angular deformity or a functional interference from pressure on blood vessels, nerves or tendons results. All of these changes are in accordance with Wolff's law of the physiologic activity of bone.

4 *The Application of These Points to the General Mechanism of the Commonest Lesion of Bone, Which is Fracture*—Let us apply our knowledge of stress and strain to the general mechanism of fracture, which is the commonest lesion affecting bones. Any direct trauma suffered by the body results in stress transmitted to the body and the bones supporting the body, and these stresses can be divided into component compressive and tensile factors modified by various torsion, flexion and shearing stresses (Fig 352). In addition to that simple analysis, where a fall or severe shock has existed there are complicating vibrations and jars of the limb or body which may produce additional

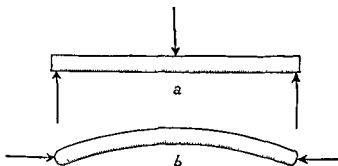


Fig 352—*a* Illustration of direct compression force applied to a long bone the ends of which are reasonably fixed. The end arrows indicate fixation of the joints at the ends of the shafts. *b* Illustration of bending of the bone with flexion in its middle and beginning pressure in its long axis from body weight and muscle pull.

rapidly alternating compression and tension forces which may prohibit the simple mechanical analysis of any given break. The additional vibrations mentioned may break or modify the bone, when it is under a severe bending or torsional stress, almost to the point of giving way. The small vibrations may act as the last straw on the camel's back and cause a complete giving way of the osseous structure. Referring to the structure of the calcaneus, we can see that the truss-like structure of the bone, which is found in its cancellous portion, is designed to take up stress on account of its supporting character like the arches of a bridge. The hard, rigid, and form producing com-

pacta which encloses the cancellous portion, giving shape and rigidity to the long bones, is not intended to act as a great force resister

To simplify the study of fracture in long bones, let us consider that the principal forces which act on an extremity are either compression or torsion strains. Compression rarely acts at a direct right angle to the long axis of the bone, as in the leg, but usually with some obliquity. Where it does press against a long bone we have a compressive strain and opposite to this point on the other side of the shaft of a long bone there is a corresponding point of maximum tensile force which endeavors

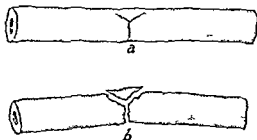


Fig 353—An example of compression force applied to a long bone in accordance with diagram in Fig 352. The plane of separation starts at *a*, and the bone yields first from the tensile force opposite the point of compression, giving a more or less transverse fracture with breaking out of the fragments.

to tear the bone apart (Fig 353). We have thus two forces acting at the same time, one endeavoring to break the bone in by pressing upon the surface on the one side, and the other a transmitted force endeavoring to pull it apart and overcome this tensile adhesion on the opposite side. A physical analysis of these forces in osseous structure shows that a long bone tends to give way from a tensile force much sooner than from an equal compressive stress (Fig 354), that is to say, the ratio varies as about 2 to 3, ordinary bone shaft being of such structure that it must yield to a tensile force which pulls it apart sooner than an equal compressive force which attempts to crush through it at a given point. Consequently, a compressive force must

be greater to accomplish a fracture—as 3 to 2 compared to a tensile force which will tear the bone apart and produce a solution of continuity. It is not difficult to understand, then, that long bones giving way from tensile stress sooner than from compressive strain will be rarely fractured except in a trans

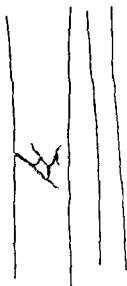


Fig. 354—Tracing of a skiagram of an actual case illustrating the mechanism described in Fig. 353



Fig. 355—A second illustration tracing from skiagram showing fracture by compression violence resulting in a transverse separation of the bone. Note that exact transverse fracture must be rare and some obliquity is bound to be present in the plane of separation

verse or oblique plane because there is a progressive giving way of the structure of the bone as it bends in resistance to these two types of force. The divisional line of separation of osseous tissue develops just the same as in a steel beam subjected to bending compressive pressure (Figs. 355 and 356). Structurally these points have all been worked out in steel beams in our large

modern buildings, and we find that osseous structure tends to give way in the same manner. One of the transverse or oblique fissures that develops when the compressive and its accompanying tensile or pulling apart force are acting usually becomes the main plane of separation and we find, therefore, that following a compressive force there is usually a true oblique fracture. Should the force act quickly and with more than sufficient power to break the bone, we will find an almost transverse shearing off of the

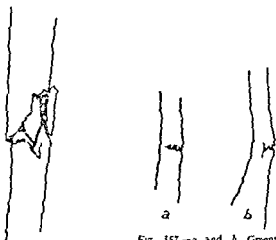


Fig 356.—Another example of an oblique fracture from a slow moving force with the broken-out fragment on the side of the shaft exposed to the tensile force which tears apart the bone fragments.

Fig 357—*a* and *b* Greenstick fractures in "children. Are tracings of skiagrams. Note the tendency to conform to the diagrammatic mechanism used for illustrating compression fracture. They are merely subdivisions.

bone's continuity. Forces applied more slowly and with no great excess of power to break the bone will cause a more oblique fracture along one of the fissures which develops as the bone separates. These fractures are commonly termed flexion fractures in contradistinction to a second class known as torsion fractures. Buckling fractures, greenstick fractures, which are really rare, are subdivisions of flexion fractures and are a more or less transverse or oblique separation of the bone continuity (Fig 357)

In buckling fractures the compacta breaks at its thinnest point on the side of the shaft of the bone subjected to the greatest compression stress, usually becoming angulated or overlapped in the longitudinal axis. In greenstick fractures the compression force applied is usually not sufficient to cause a complete fracture and it ceases when it has reached a point short of complete division of the osseous tissue. The fractured

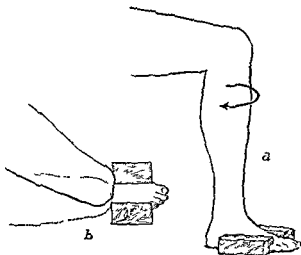


Fig. 358.—Diagram illustrating torsional violence applied to the leg. *a* Imagine a thigh held rigid and the foot turned out in the direction of the arrow by pushing the block outward. This is the actual mechanism in leg fractures from torsional violence caused by slipping or twisting of the foot outward. *b* Imagine the foot held securely by blocks and the thigh rotated outward to the position of the dotted lines. This gives the same mechanism, resulting in the same type of fracture as *a*. The reversal of this movement causes the rare spiral fracture which proves the rule.

ends consequently are then interlocked with a slight angularity and very little lateral or rotatory displacement. These fractures are found in children's bones which, as we have mentioned, contain a smaller proportion of calcium salts. They are more elastic and are tougher than the brittle bones of adults, and we expect to find these incomplete fractures in children on that account. The heavy vascular periosteum of children's

modern buildings, and we find that osseous structure tends to give way in the same manner. One of the transverse or oblique fissures that develops when the compressive and its accompanying tensile or pulling apart force are acting usually becomes the main plane of separation and we find, therefore, that following a compressive force there is usually a true oblique fracture. Should the force act quickly and with more than sufficient power to break the bone, we will find an almost transverse shearing off of the



Fig 356.—Another example of an oblique fracture from a slow moving force with the broken-out fragment on the side of the shaft exposed to the tensile force which tears apart the bone fragments.



Fig 357.—a and b Greenstick fractures in children. Are tracings of skiagrams. Note the tendency to conform to the diagrammatic mechanism used for illustrating compression fracture. They are merely subdivisions.

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true oblique fracture I have tried to explain that an oblique fracture is caused by compression violence applied against the shaft of a long bone. The angular points of the break are on opposite sides of the shaft. When we study spiral or torsional fractures we find the sharp points of the fragments are on the same surface of the bone, and usually on the posterior surface of a bone such as the tibia. To understand, we must compare a long bone to a cylinder of more or less uniform construction, which is subjected to axial torsion beyond the point of elastic limit. When a cylinder gives under this axial torsion, a loss of continuity follows and a spiral separation results (Fig 359). This spiral separation takes the opposite direction to the torsional violence that is to say a spiral fracture runs down the shaft of a long bone in either the right hand or left hand direction, much as a corkscrew edge. Under torsional strain the bone starts to give at some weak point and tends to unroll in its longitudinal continuity giving this spiral character (Fig 360). However we know that fractures are not easily or simply analyzed and we must not forget that as a spiral separation down the shaft of a long bone persists there is going to be added some flexion stress from the change of weight bearing from falls or from muscular action. The whole effect then rarely becomes a true torsion unless the leg is supported and the foot or body twisted completely around when no weight bearing is in operation. If flexion is combined with torsion as it is in the usual spiral fracture we may expect that there is a longitudinal plane of separation connecting the initial points where the bone started to give under torsional stress. We find that each fragment contains a sharp or wedge shaped point one lying vertically above the other. Young bones, being more elastic present a spiral which is steeper than that found in the bones of adults. It is also true that in the small long bones even those of the hand the spiral fractures have a steeper pitch than those involving the large bones.

In the application of these principles to fractures of the leg we find that the peripheral portion is the foot and the proximal portion is the leg and thigh. Usually fractures occur in the

bone is also a factor in the production of greenstick type of fracture

The application of torsional violence results in a spiral character of the resulting break in the bones (Fig 358) Let us discuss the mechanism of ordinary spiral fracture of the leg There are two mechanisms, that is, either the periphery or foot

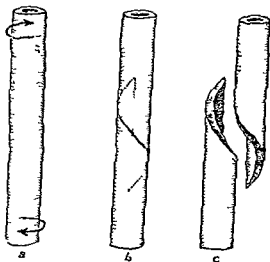


Fig 359—*a*, A bony cylinder subjected to torsional violence. The lower end represents the foot portion twisted outward in the direction of the arrow as in an outward slipping of the foot. The upper arrow indicates the restraining force and fixed knee. *b* The tendency for tubular bone to unroll in response to torsional violence. The two points of beginning separation usually lie on the same surface, one directly above the other and connected by a plane of spiral separation of varying angles. *c* Complete separation of bone tubular shaft which occurs experimentally when torsional violence is applied illustrating this mechanism.

portion of the limb is fixed and the bone is subjected to a twisting violence from the trunk above, or, as is more commonly the case, the proximal portion of the limb is fixed and the distal portion or foot undergoes the twisting violence. This is the common mechanism induced whenever the foot slips outward in walking or stepping off a small elevation. A torsional fracture is not a

conclude that this is so. Why do we find that this is so? Because in practically all torsional fractures of the right leg the spiral separation of the bone is left handed, that is to say, the spiral starts at the top and goes down in a left hand direction, like a spiral staircase, opposite to the torsional violence which twisted the leg outward or to the right. In the left leg the op-

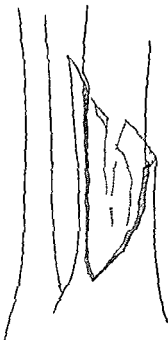


Fig. 362—Torsional fracture of lower third of leg partly reduced. The spiral unrolling of the bone corresponds to the diagrammatic representation and the difference from compression fracture seen in Fig. 361 is evident.

posite is true and spiral fractures there are found to be almost universally right handed. The rare exceptions to this rule are caused by conditions I have mentioned when the periphery or foot portion of the leg is fixed when caught between two points, such as a railroad frog or blocks of some kind. Even with the peripheral portion fixed the body or proximal portion may be twisted in either direction. If it is twisted outward we would find

leg because the foot is violently and suddenly twisted outward. Remember, I am speaking of torsional fractures not of fracture from direct compressive violence (Fig. 361). It is very rare that in walking we tend to twist our foot inward. The normal

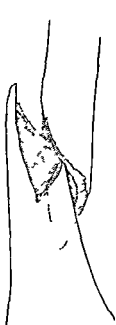


Fig. 360—Tracing of a spiral fracture of the femur illustrating the mechanism of spiral separation. Note how nearly it conforms to the diagrammatic figures.



Fig. 361—Compression fracture of lower third of leg. Boy riding a bicycle caught next to a fixed wall and leg subjected to lateral pressure. No torsion, no spiral fracture. Note the oblique plane of bone separation and the conformity to type of the direct violence fracture.

position of the foot is properly thrown slightly outward especially when we are in the act of swinging it forward. If it strikes an object or is caught during its excursion we expect the torsional stress to be exerted in an outward direction and an examination of the roentgenograms of these torsional fractures leads us to

CLINIC OF DR GATEWOOD

PRESBYTERIAN HOSPITAL

CARCINOMA OF THE RECTUM

Summary Prolapse through sacral anus following resection of carcinoma by Kraske method one year previously Utilization of prolapsed bowel in reconstruct on of rectum

THE patient upon whom I am to operate this morning first came to me a little over a year ago She is a single woman, seventy years of age At that time she complained of weakness, loss of weight hemorrhoids and tarry stools The history alone made me suspicious of a carcinoma of the rectum, as she stated that the hemorrhoids had been present for about four months and it is unusual to have hemorrhoids suddenly develop in people of that age Close questioning failed to reveal a history of the passage of mucus or pus but microscopic examination of the stool showed some pus There was no history of constipation, but all of the stools had been mushy so that obstruction would necessarily have had to be almost complete to give symptoms of ileus She had complained of very little pain although there was a history of some discomfort particularly when sitting for a considerable time She first noticed the loss of weight about four months before I saw her and thought that altogether she had lost about 20 pounds

Physical examination was practically negative except for the rectal findings and the evident loss of weight A cauliflower like mass about 3 cm in diameter could be felt on the anterior surface of the rectum It seemed to be somewhat movable and bled rather freely Two small hemorrhoids were present, but were not tender and could not have been in any way responsible for her discomfort

a reverse of the rule given, and if inward, the usual type of spiral separation would ensue.

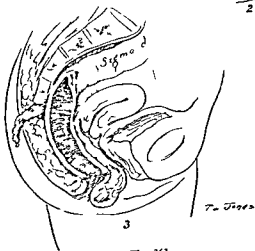
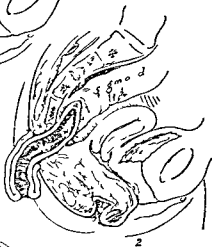
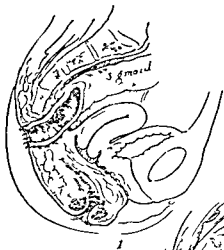
When we come to reduce fractures, to apply splints, and extensions we must bear some of these basic and elementary points in mind, and in dealing with any specific fracture an attempt must be made to reverse the action of causative force. All fractures are worthy of a physical analysis. That leads to better understanding of their pathology and, consequently, to better treatment.

Under ether anesthesia I made a midline incision from the middle of the sacrum to the anus and removed the coccyx. This allowed me plenty of room to work. The rectum was entirely freed both in front and behind care being taken not to enter the vagina. The bowel was then split longitudinally along the posterior wall with the idea that it might be possible to do a local operation and remove the tumor with the cautery without destroying the continuity of the entire rectal wall. However, the tumor was so extensive that this was found to be impossible and a resection of the gut at the rectosigmoidal junction was deemed necessary. Considerable difficulty was encountered in bringing the bowel down sufficiently to make a sacral anus without tension but this was finally accomplished by suturing the mucous membrane to the skin just below the sacrum with interrupted silk. The lower segment of the rectum was removed leaving the anal sphincter and about 2 cm. of the mucosa. There were a few small glands in the fat which on section proved to be inflammatory.

The patient made an uneventful recovery and left the hospital in about four weeks. There has been no evidence of recurrence but she complained from the start of a good deal of discomfort due to incontinence. She does housework and it has been imperative that she resume her duties in order to make a livelihood. About six months after her operation she came to me begging for some relief. At the time of her operation I had proposed an inguinal colostomy in the event that I could not preserve the normal canal but she absolutely refused to consider it. I again suggested an abdominal anus but it was refused.

The question of the type of operation to be done in carcinoma of the rectum is still open to considerable debate. Personally I feel that no set rule should be given and that the operation should be planned in each instance depending upon the location, the type of tumor and the condition of the individual patient. Here we have a woman past seventy who is only a fair risk. She had

Fig. 363—1 Diagram of condition at completion of original operation.
2 Condition at time of admission for second operation. Note prolapse of bowel through sacral anus.
3 Completion of second operation.



T. Jones

Fig 363

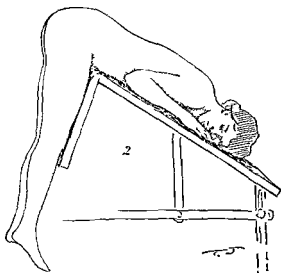
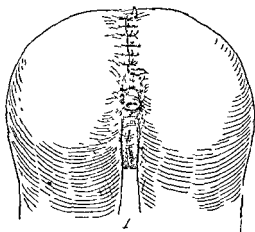


Fig 364—1, Conclusion of operation, note gauze drain in upper angle of incision and tube stitched into rectum 2, Illustrating position of patient on the table during operation.

no evidence of metastasis and the growth did not seem to be very extensive. In such a case it seems to me much safer to do a one-stage operation from below. When seen early enough local operation unquestionably gives excellent results, with a very low mortality and a good percentage of permanent cures. This is especially true of tumors occurring in the lower 3 cm. of the bowel though unfortunately they comprise only about 6 per cent. of cancers of the rectum. Such an operation resembles the removal of a cancer of the lip or an epithelioma of the skin. It can be done best by means of the cautery knife, the raw surface being sutured over after removal of the tumor and the bowel closed. In the more advanced cases if the tumor is low down a radical removal of the entire section of the rectum with the neighboring glands and fat is the operation preferred by most surgeons although a certain number insist that an abdominal exploratory should be made in every instance. The sacral type of operation was introduced by Kraske and has been variously modified by Quenu, Bardenheuer, Harrison Cripps and others. It is limited to tumors in the lower 5 or at most, 6 inches of the bowel. The greatest objection aside from the examination of the abdomen for metastases, to this operation is the incontinence of which this patient complains. Some patients develop a forty-eight hour habit and have very little difficulty. Where it is possible to retain a part of the anal sphincter, even though small, patients have a surprisingly good functional result. If I had to have an artificial anus I believe I should prefer the inguinal or abdominal type. Patients with a left inguinal colostomy not only have better control on account of the loop of bowel which forms a reservoir like a plumber's trap but also because, on account of its greater accessibility, they can wear a better protective apparatus.

As this woman refused further operation, I advised her to follow a careful diet and to content herself with her lot.

She now returns with a somewhat different picture. During the past six months she has gradually developed a prolapse through the sacral anus. This has caused her a great deal of discomfort. It projects, as you can see, about 6 inches when

CLINIC OF DR G L McWHORTER

PRESBYTERIAN HOSPITAL

AN UNUSUALLY LARGE SARCOMA INVOLVING THE STOMACH

Summary Salient points in the clinical record results of exploratory operation necropsy report frequency of sarcoma of the stomach varieties of growths and clinical behavior

MR J D, aged forty five entered the hospital March 23, 1919 on the medical service of Dr J B Herrick The patient complained of a large swelling in his abdomen He stated that he was kicked in the left side of his abdomen by a mule in August, 1918 He was stunned for half an hour and made quite sick at his stomach by this blow Following this he felt perfectly well and did carpenter work until October During October he developed an area of tenderness in the left side of his abdomen extending from the umbilicus to the ribs This came on suddenly one day with a feeling of chilliness and aching in his back arms and legs On the evening of this day he became nauseated about one half hour after supper and vomited Pain developed in the left upper quadrant and remained fairly constant In November he passed loose bloody stools three to four times a day for a few days and at that time noticed a hard lump beneath the margin of the ribs on the left side This mass gradually increased in size and about December 10th it softened in its upper part and increased in size downward very rapidly Marked swelling of the abdomen began and has progressively continued since that time He has had irregular periods of pain severe enough to keep him awake These were sometimes relieved by lying on the left side or by having a bowel movement

she coughs or strains, or after she is on her feet for a short time. It is very readily replaced when she lies down. The idea occurred to me that it might be possible to restore the fecal current to its original channel by making use of this prolapse, and that is what we shall attempt to do this morning.

I am making a curved incision around the artificial anus and I am also dissecting out the old scar, continuing my incision as far down as the original anal opening. I am dissecting the bowel loose from the sacrum for a distance of 2 or 3 inches. In doing this I have opened the peritoneal cavity in front. Into this opening I am packing a laparotomy pad. With the prolapse, I now have plenty of viable gut to bring down to the old anal opening. The freed bowel, as you can see, is about 8 inches in length. I will divide the anal sphincter at the site of my previous incision. I am now closing the peritoneal opening with catgut. Although this opening was made accidentally, it has been of considerable benefit, as it enables me to bring the prolapsed bowel down to better advantage. You will notice that there is no difficulty in suturing the rectum to the anal mucosa by means of interrupted silk sutures. I have been very careful to avoid any tension. It is still necessary to suture the subcutaneous tissues with a few catgut sutures, diminishing the dead space, and thereby lessening the likelihood of necrosis. I am now inserting a large rubber tube into the rectum, allowing it to extend well above the anastomosis. It will be held in place by a couple of silkworm gut sutures. The retrorectal space is packed with iodoform gauze and a few interrupted sutures inserted in the line of the incision (Fig. 364).

Postscript—Three months after operation the patient is entirely well and has resumed her usual work. She has no trouble with incontinence. There is no evidence of recurrence of the carcinoma, but there is some tendency to stricture formation at the site of the anastomosis and dilatation with bougies may be necessary later.

cent, large lymphocytes 6 per cent, small lymphocytes 7 per cent, eosinophils 1 per cent, basophils 1 per cent. The hemoglobin was 56 per cent. The systolic blood pressure was 186 and the diastolic 124.

The abdomen became very much more prominent during the two weeks following his admission to the hospital and dyspnea became very marked. The tumor itself increased in size very rapidly and the fluid increased in amount so that the abdomen became immense in size. His temperature with two or three exceptions did not go above 99° F.

Dr. Herrick transferred him to my service for a laparotomy to remove the fluid and relieve the pressure, and also to explore the abdomen, as the patient otherwise was in fairly good condition.

Operation (April 14 1919)—Under local anesthesia I made a left rectus incision and removed about 2500 c c of clear straw colored fluid. There was a huge tumor present. It was continuous with and passed over the stomach, fusing with the anterior edge of the liver.

In the left upper quadrant a thick leather walled palpable mass containing fluid could be outlined. This was continuous with the tumor and in the position of the body of the stomach. It felt like a leather bottle stomach and extended high up under the diaphragm. The large tumor extended down completely over the intestines. The intestines as far as could be palpated were free and posterior to the tumor. The mass on gross examination was slightly lobulated, but was smooth and gray over the stomach somewhat resembling a carcinoma. However large dilated veins were present over the main mass lying below the stomach and extending to the pelvic inlet. Pieces of the tumor were removed for microscopic examination and the abdomen was closed with reinforced sutures.

The patient noted immediate relief following the removal of the fluid and subsequently complained less. About ten days after operation the patient became worse, his pulse poor and he developed incontinence of urine and feces. The day before he died he became somewhat delirious. He was irrational at times.

The patient has been constipated since Christmas and has had to take cathartics frequently the stools sometimes becoming loose and bloody after their use. He has had dyspnea constantly since Christmas and has recently developed a cough. He has had nausea and vomiting associated with epigastric distress which come on immediately after eating. For the past three months he has had a frequent desire to urinate, particularly when standing. He has lost 19 pounds (185 to 166) in the last six months.

His previous history is negative except for the kick from the mule in August.

On examination the patient is found to be a well nourished male, he walks slowly and has a prominent abdomen.

The examination of his head is negative. On examining the chest the breath tones are normal but excursion is limited. The lungs and heart are pressed upward by the mass filling both sides of his abdomen. The abdomen is very prominent, the size of an eight months' pregnancy due to a large mass fairly smooth anteriorly, but having an irregular outline. There is evidence of only a moderate amount of fluid in the abdomen. The extremities are negative. There is no edema.

Fluoroscopic examination by Dr Herrick March 27th, showed the heart pushed markedly upward. The barium meal was not well seen in the stomach on account of the large tumor.

The urine examination was negative except for a trace of albumin.

The secretory test meal at the end of one hour March 29th gave 50 c.c. There was no free hydrochloric acid but the total acidity was 45. The Weber test for blood was positive. On April 4th a secretory meal gave 125 c.c. of normal appearing contents. It titrated 18 free hydrochloric acid and 46 total acidity. The test for blood was positive.

Examination of the stools was negative except for a positive Weber blood test.

On March 26th there were 3 800 000 erythrocytes and 7000 leukocytes. The differential leukocyte count gave polymorphonuclear leukocytes 57 per cent. large mononuclears 17 per

cent, large lymphocytes 6 per cent, small lymphocytes 7 per cent eosinophils 1 per cent, basophils 1 per cent. The hemoglobin was 56 per cent. The systolic blood pressure was 186 and the diastolic 124.

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and breathing was labored. This became progressively worse until his death, April 27, 1919

On microscopic examination of the tissue removed we found typical sarcoma cells. Some of the cells were spindle shaped and some were mixed embryonic cells

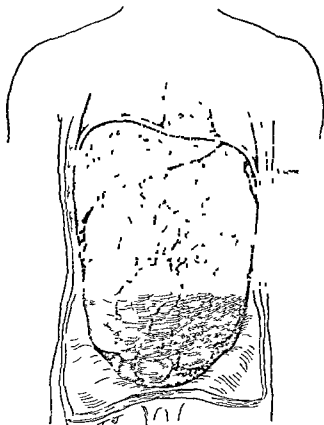


Fig 365 —Sarcoma with large cavity opening into the stomach. Large veins present over the surface and an irregular lobulated lower portion.

Before continuing the discussion I will give Dr B O Raulston's findings at the necropsy

When the abdominal cavity is opened in the usual manner

a grayish, irregular, nodular tumor is found occupying most of the cavity from the pelvis to the diaphragm (Fig 365). The

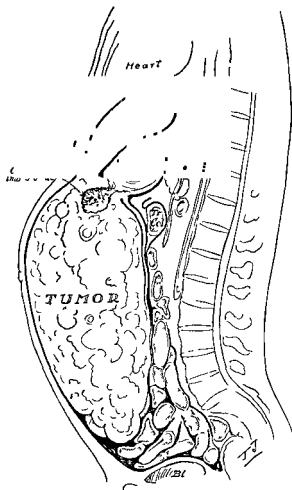


Fig 366—Sketch showing the relation of the tumor to the stomach, fusion with liver, and freedom from the intestines Drawing somewhat schematic

stomach is not seen, the lower margin of the left lobe of the liver is barely seen and is firmly adherent to the mass, the small

bowel is for the most part crowded into the pelvis and space back of the lower end of the tumor. The omentum is represented by a narrow fringe of yellowish tissue across the lower and posterior portion of the tumor and in it there is a mass of veins so dilated that they measure from 0.25 to 0.75 cm in diameter.



Fig 367 Photograph taken at necropsy showing the tumor (1) and the peritoneum (2) and the peritoneum (3) and the peritoneum (4).

In the peritoneal cavity there are about 1500 to 2000 cc of a straw-colored fluid. When the lower portion of the tumor is lifted forward the transverse colon is seen passing across and loosely adherent to its middle posterior portion. The maximum dimensions of the mass are transverse 3 cm vertical 28 cm.

anteroposterior, 16 cm With the left lobe of the liver, the spleen, pancreas, stomach, and duodenum, all of which are apparently



Fig. 368—Photograph showing tumor (1) mucosa over tumor of the stomach wall (2) sinus through the stomach wall into the tumor mass (3), esophagus (4) liver (5)

of normal size the tumor weighs 18½ pounds (8.53 kilograms). It is continuous with the wall of the greater curvature of the

stomach and its invasion of this wall is shown in Figs 366 and 367. These figures also show the relation of the tumor to the spleen, liver, and stomach.

In the body of the stomach there is an irregularly round, rough cauliflower like mass with an average diameter of 7.5 cm. In the central portion of this mass there is an irregularly shaped necrotic region through which a sinus opens into the upper and left portion of the tumor indicated in Fig 368. It is evident that the tumor is divided roughly into three portions topographically: a single lower and two upper portions (Fig 361). The left one of the upper portions fluctuates over its anterior surface and when pressure is made upon it thick brownish fluid is forced through the opening into the stomach.

By microscopic examination of pieces of tissue removed from various parts of the tumor a diagnosis of sarcoma mixed round and spindle cell is made. The main points in the anatomic diagnosis are as follows: Bilateral pulmonary embolism, thrombosis of the left iliac vein, large sarcoma of the stomach with adhesions to the liver, spleen, pancreas and transverse colon, ascites, marked dilatation of the veins in the omentum, displacement upward of the diaphragm, recent healing surgical incision of the anterior abdominal wall, emaciation and anemia, fatty changes in the liver, kidneys and heart muscle, moderate atheromatous changes in the lining of the aorta and coronary arteries.

The report by Dr. Raulston is of value because non-carcinomatous neoplasms of the stomach are rare. Lipoma, fibroma, adenoma, and myoma have been found, but sarcoma is the most frequent. Fenwick found sarcoma occurring in 5 to 8 per cent of all primary growths; however, most sarcomas are diagnosed clinically as carcinoma. Fewer of these are operated since obstruction is less common than in carcinoma and it occurs late as a rule when present. Since their growth and metastases are very rapid they are usually inoperable when first seen and necropsies are not always obtained.

Corner and Fairbanks collected 175 cases of primary sarcoma of the gastro-intestinal tract—58 of these were sar-

comas of the stomach and 64 sarcomas of the small intestine. The location differs from carcinoma in that sarcoma occurs more frequently in the small, while carcinoma occurs much more frequently in the large, intestine. Sarcoma occurs usually in the body of the stomach and in the esophagus, about an inch above the cardia, while carcinoma occurs chiefly at the pylorus and the cardia. Schlesinger states that sarcoma develops chiefly from the greater curvature.

Sarcoma may be primary or secondary in the stomach. Any type of sarcoma may be present, but with the exception of lymphosarcoma primary sarcoma usually arises from the muscularis or submucosa. With the exception of lymphosarcoma, secondary sarcoma is rare, but the lymphosarcoma is more frequent as a secondary than a primary growth.

Primary lymphosarcoma may occur at any age, but it is most frequent between twenty and thirty five years, while other types of sarcoma appear more frequently between forty and fifty.

Practically all types of sarcoma have been found—myo-, fibro-, angio-, lympho-, myxo-, alveolar, round-cell, mixed-cell, and spindle-cell sarcoma. Over one half of these have been found to be of the round cell variety (Fenwick). These growths may be annular, polypoid, or may be circumscribed nodules and may grow into the lumen or extrinsically. Lymphosarcoma usually and other types of sarcoma sometimes form extensive infiltrations in the wall. The former metastasizes chiefly along the lymphatics.

In nearly all sarcomas the mucosa is intact early, but later it may ulcerate. A sarcoma may form a diffuse tumor involving the entire stomach, spreading, unlike carcinoma, into both the duodenum and esophagus.

The large subserous tumors are liable to undergo cystic degeneration. In one case reported the cavity was opened at operation. Many of these large tumors are of the spindle cell type. Lymphosarcoma especially may tend to dilate the wall, but it may also obstruct the lumen due to its size or due to interference with peristalsis by infiltration of the wall, even though the lumen may be dilated. Kundrot states that metastatic

growths in the intestine from lymphosarcoma never produce stricture, but lead to dilatation

Metastases from primary sarcoma of the stomach are common. Corner and Fairbanks found secondary growths were present in 40 per cent of the reviewed cases. They found that there was glandular involvement in one third of the cases. This is especially frequent in lymphosarcoma. Sarcomas of the stomach metastasize frequently in the intestine and form nodules in the skin.

In sarcoma of the stomach no definite clinical diagnosis can be made as a rule, especially to distinguish it from other malignant growths. The difficulty becomes more evident when we know that in less than one half of the cases reviewed by Corner and Fairbanks a palpable tumor was noted.

There are a number of symptoms which are an aid in the diagnosis, and when sections can be taken the diagnosis becomes certain. There are usually early wasting and anemia, vomiting is frequent, pain is often fairly constant, jaundice may be present. Irregular fever is common and there may be a persistent leukocytosis with an increase of lymphocytes. A tumor may be palpable, and this may be very large without symptoms of obstruction, or if obstructive symptoms are present, they appear relatively later than in carcinoma. This is partly due to the location of the sarcoma which is usually in the body of the stomach. Hemorrhage is usually absent or is a late complication, although occult blood is found after the mucosa is ulcerated. The average course of the growth from the onset of symptoms is, on an average, six months.

Sarcoma forms metastases frequently in the skin and in intestine. If nodules are present in the skin microscopic examination will usually determine the diagnosis, but even here we may have an associated carcinoma of the stomach. Kundrat states that metastatic lymphosarcoma never produces stricture of the intestine but dilatation, while carcinoma forms a stenosis. In diffuse lymphosarcoma of the stomach dilatation may occur without stenosis of the pylorus. This should be differentiated from diffuse carcinomatous infiltration of the stomach which

thickens and contracts the stomach, giving rise to the malignant variety of 'leather bottle' stomach. There is a similar condition which may be benign due to diffuse fibrosis of the stomach, sometimes called *linitis plastica*.

Swelling of the spleen due to congestion and hyperplasia is a frequent finding in both primary and secondary sarcomas of the stomach. Schlesinger found it present in all of his cases.

According to many authors no constant differences occur in the chemism of the stomach in carcinoma and sarcoma.

It is interesting to note that after one test meal in the case reported normal free hydrochloric acid was found.

Particles of the tumor may be found in the vomitus or may be obtained by a stomach tube.

The prognosis in sarcoma of the stomach even if operated early is poorer than in carcinoma. It is especially bad in lymphosarcoma. Death is more frequent in sarcoma through a perforative peritonitis than in carcinoma.

Brodowski reported a very large myosarcoma connected with the greater curvature of the stomach, weighing 12 pounds. It was 30 to 40 cm long, 12 cm thick, and 16 cm broad. There was cystic degeneration with a cavity containing a purulent fluid in his case.

In the differential diagnosis there are some extrinsic conditions which should be considered and remembered. Tuberculous lymphadenoma is perhaps one of the most frequent conditions found. Lymphosarcoma is the most frequent primary retroperitoneal neoplasm. There may be an abscess of the retroperitoneal glands. Lipoma is found most frequently under the mesentery of the large or small intestine. Carcinoma of the testicle may involve the ileocolic glands during the early stages.

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INCISED WOUND OF HAND

Summary Compound fracture of metacarpophalangeal joint with complete severing of dorsal tendons tendoplasty postoperative treatment by massage and active motion

THIS patient comes in with a bleeding wound on the back of the left hand. He states that while operating a band saw his hand slipped and the saw cut a glancing blow across the joint at the base of the fourth finger and the fifth finger at a point just distal to the base.

On examination I find a bleeding wound laying the fourth metacarpophalangeal joint wide open. The dorsolateral third of the head of the metacarpal or knuckle is entirely cut through and held only by a strip of periosteum at its upper end.

There is a thin piece cut from the first phalanx which is attached to the capsule of the joint. The extensor tendon to this finger is entirely cut through.

On testing out the function of the finger I observe that even though the extensor tendon is entirely cut there is an appearance of some extension through traction on the web by the third and fifth fingers. There is extension of the fifth finger but on examination of the wound the tendon from the extensor digitorum communis is found to be cut and the other extensor tendon to the little finger the extensor digiti quinti proprius is partially cut. The wound extends distally without involving the joint of this finger. The fourth interosseous muscle is cut at the level of the joint. It inserts on the ulnar side of the base of the fourth finger.

There are a few important anatomic facts which it is important to remember in injuries of this region. The synovial sheaths of the extensor tendons are not present over the knuckles but begin about the middle of the metacarpal bones and extend an inch above the wrist. These sheaths do not intercommunicate as do those of the flexor tendons and consequently the

results of infection are not so severe. The tendons may retract an inch or more if cut in these sheaths, but if cut in other parts of their course they rarely retract more than half an inch. At the metacarpophalangeal joint the tendon aids in forming the dorsal ligament of the joint capsule, its border being indefinite. On the back of the first phalanx the tendon receives at its sides the partial insertions of the interossei and lumbricales muscles which send fibers into the capsule of the joint. These fibers form an aponeurosis which passes over the tendon like a sheath. The ligamentum capitulum transversum separates the distal portions of the interossei muscles from those of the lumbricales. The former run dorsal to this ligament and the latter volarward. On account of the close relationship of the extensor tendon to the capsule the majority of tendon injuries at this point extend into the joint. When these joints become infected, as frequently happens drainage should be established preferably through bilateral openings.

The tendons forming the *extensor digitorum communis* are attached to each other just above the metacarpophalangeal joints by strong bands called *juncturae tendinum*. This is the reason that it is difficult to extend any but the first finger alone.

There are no motor nerves in the region of this injury and consequently the repair of the tendons and the head of the metacarpal, re-forming the joint are the only problems. If we can maintain this piece from the head of the metacarpal in position with the capsule and tendon sutured and provided we can avoid subsequent infection, we should get a return of normal function.

Operation.—The fragment from the head of the metacarpal is first placed in position and held there by a suture through the capsule at its insertion in the neck. The large flap of capsule is now turned back in normal position and sutured to its cut edge also aiding in keeping the bone fragment in position. The thin piece of bone from the base of the first phalanx is cut away and a part of the capsule sutured to cover the cut surface of the bone. The aponeurosis over the distal fragment of the cut tendon is now split down a short distance so that by extending the finger a good end for suturing is obtained.

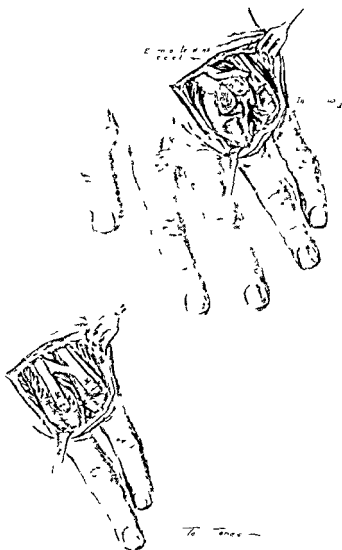


Fig. 369.—Incised wound of hand. Saw cut through the bone and joint with involvement of the extensor tendons of the fourth and fifth fingers. Reconstruction of joint and tendons.

I am suturing the ends accurately together by using two simple through and through sutures and one long mattress suture of catgut. A medium size chromic catgut is probably the best suture. The cut tendon to the little finger and the interosseous muscle are sutured in a similar manner.

All hemorrhage has now entirely stopped through ligation of several vessels. The subcutaneous tissues are drawn together over the tendons with fine catgut and the skin is sutured with waxed linen without drainage. In cases where there may still be a slight oozing of blood a few strands of iodoform gut may be left in the lower angle of the wound as a drain for twenty-four hours.

The hand is put on an anterior padded splint with the fingers in extension and carried in a sling. Daily dressings are necessary for a few days until all danger of infection is over.

Passive motion especially lateral motion and massage will be started at the end of a week. Active motion will be started at the end of two weeks with very limited movement, increasing to full excursion only by the fourth week. The danger of too early use is that the ends of the tendon may separate yet if the fingers be too long immobilized adhesions may form. There is danger of loss of function in the metacarpophalangeal joints due to vasomotor and trophic changes with edema from long immobilization in extension. We therefore permit the use of these joints as much as possible from the beginning of treatment and encourage active motion and massage by daily removal of the splint.

After history—The wound healed by primary intention and the stitches were removed at the end of a week. The splint was removed for daily massage and left off at the end of two weeks. There was no evidence of ankylosis in the joint. Active motion is to be gradually increased.

CLINIC OF DR CHARLES B REED

WESLEY MEMORIAL HOSPITAL

BREECH PRESENTATION—MANAGEMENT

Summary Nephritis in pregnancy as an indication for emptying the uterus technic of extraction, importance of maintaining correct position of operator's hands while delivering the baby's arms technic of pubiotomy, its advantages conditions under which it becomes the operation of choice

GENTLEMEN I have the pleasure today of showing you two cases of breech presentation, with their management

The first case is Mrs G, of Indiana, III para, age thirty two, married eight years, one child living no miscarriages She came to our service March 3 1919 She had her last period in July, the date being uncertain About two weeks before she entered the hospital she noticed a puffiness all over the body, especially of the lower extremities She says that three weeks previous a urinalysis had been made and the urine pronounced normal, but ten days later an examination revealed albumin Her father and mother both died of nephritis She has been getting worse gradually

In the hospital urinalysis showed normal acidity, albumin 4 plus, many casts, both hyaline and granular, white blood cells numerous, specific gravity 1015 to 1018

The blood showed a hemoglobin of 70 per cent, white blood count, 10 000, Wassermann negative, blood pressure, 180 and 98

There was no cyanosis and no jaundice, but the face showed pallor and the body some weakness Thyroid small, eye grounds normal Teeth have some pyorrhea pockets at the gum margins, but no abscesses

Examination of the uterus revealed distinct heart tones and by measurements a pregnancy of approximately seven months

The diagnosis was acute nephritis

The woman was placed on a strict milk diet with the intention of carrying her along from day to day and resorting to interference only if danger to her should demand it. Our hope was that she would go to the eighth month since at that time the child would have a better chance of survival.

The blood pressure did not improve. Analysis of the urine today shows about the same condition as when she entered. The patient has felt fairly well until yesterday, when she began to complain of weakness and cloudy vision. Feeling somewhat nervous about the possible onset of eclampsia another examination was made of the abdomen which showed the child in the sacro-right anterior position, with measurements indicating a length of 48 cm. and heart tones of 135. It was decided to induce labor.

This morning, therefore, at 9 o'clock a Voorhes bag No. 4 which is used frequently in this clinic was introduced without anesthesia. Pains began at once and have continued regularly. The bag was expelled at 1:13 P. M. while the pains are continuing regularly up to the present time. Examination shows complete effacement of the cervix and complete dilatation of the os. Under ether anesthesia, therefore, we shall now proceed with the extraction in order to avoid the exhaustion of a long labor.

The hand enters the multiparous vagina rather readily. We rupture the membranes in passing through them. We seize the anterior foot of the child and deliver slowly to avoid trauma to the mother and child. The foot now appears followed by the knee. You will observe that the foot seems unusually swollen. As the breech appears meconium is discharged which is of no significance in breech labors. The second foot comes down and the breech appears in the vulva. We now place the thumbs of both hands on the sacrum, which is wrapped in a sterile towel with the fingers underneath and make traction slowly downward and outward until the cord appears at the vulva. Ordinarily we do not have much difficulty in the extraction and rarely any delay during this stage. The arms, as a rule, furnish the first and one of the most important complications. This child is rather small and we swing it through a long arc toward the side

to which the belly points—in this case to the woman's left side. This throws the posterior arm deep into the hollow of the sacrum and makes it far more accessible and easy to deliver. Again, while keeping the left thumb on the vertebrae of the child the fingers of my left hand seize the child's left elbow and sweep the hand down over the face and chest to delivery. This is an important maneuver for if the elbow or arm is grasped by the

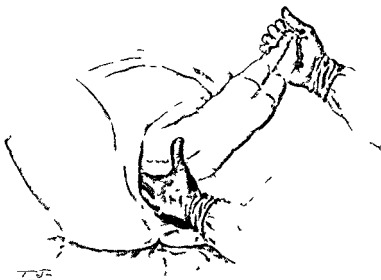


Fig. 370—Breech presentation and extraction. Delivery of the posterior shoulder and arm. Note position of thumb of left hand.

thumb and fingers together extraction may proceed in the wrong direction and result in a possible dislocation of the shoulder or fracture of the arm (Fig. 370). The body of the babe is now carried through a long arc to the opposite side. The right arm delivers almost spontaneously and the head comes down. There is no obstruction as the head delivers and no tear. The cord is not pulsating and a Pettit Clamp is therefore applied and the cord is severed at once. The child seems to be in shock in spite of the

will do an episiotomy on the side opposite to the saw. This will prevent delay in extraction and an unnecessarily large tear, if fear there should be. By putting it on the opposite side we reduce the danger of a laceration extending up to or into the pubiotomy wound in case this operation should be required.

The membranes have ruptured and the breech has entered the pelvis. The hand now enters easily the artificially enlarged

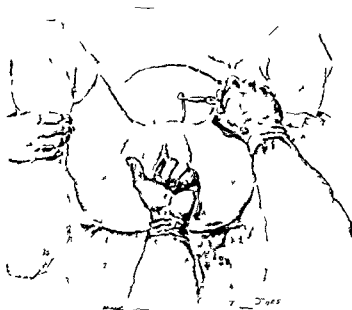


Fig. 371.—Introduction of the Doderlein needle 2 cm. to the left of the median line. The needle would usually enter on the opposite side (at point indicated by arrow) when used by the right hand.

vagina and finds the foot beside the breech. The foot is pulled down. I call attention especially to the bulk of this foot and leg. This is manifestly a large child and hence before we proceed with the extraction we shall do a preliminary pubiotomy. It is far better to do this now than to wait for the necessity. It is better both for the mother and for the baby. Applying the

handles we use an up and-down movement of the blade, avoiding as much as possible any laceration of the soft tissues. The saw goes quickly through the bone and an assistant on each side steadies the leg so as to prevent undue separation of the bones (Fig 373). There is some hemorrhage as you note but it is not serious. The assistant applies a sponge firmly to the site

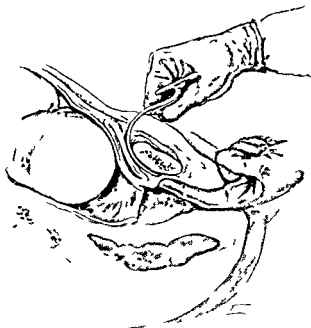


Fig 372 —The needle passes behind the bone under the control of the index finger

of the hemorrhage while we begin traction on the foot. The breech comes down easily and the body follows. Next we deliver the arms by the method you saw in the previous case. Note the position of the thumb (Fig 370). However the posterior arm in this instance is locked back of the neck and we are grateful for the additional room which the episiotomy and

will do an epiotomy on the side opposite to the saw. This will prevent delay in extraction and an unnecessarily large tear, if tear there should be. By putting it on the opposite side we reduce the danger of a laceration extending up to or into the pubiotomy wound in case this operation should be required.

The membranes have ruptured and the breech has entered the pelvis. The hand now enters easily the artificially enlarged



Fig 3 1.—Introduction of the Doderlein needle 7 cm. to the left of the median line. The needle would usually enter on the opposite side (at point indicated by arrow) when used by the right hand.

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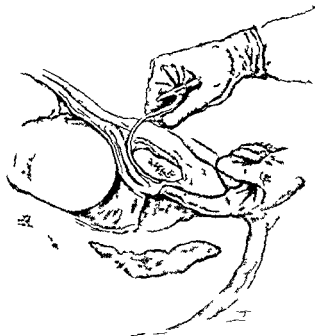


Fig 372—The needle passes behind the bone under the control of the index finger

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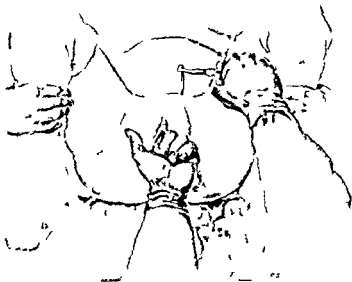


Fig 31—Introduction of the Doderlein needle (cm to the left of the median line. The needle would usually enter on the opposite side (at point indicated by arrow) when used by the right hand.

vagina and finds the foot beside the breech. The foot is pulled down. I call attention especially to the bulk of this foot and leg. This is manifestly a large child and hence before we proceed with the extraction we shall do a preliminary pubiotomy. It is far better to do this now than to wait for the necessity. It is better both for the mother and for the baby. Applying the

the length The tape shows 52 25 cm , while the estimate, as you remember, was 52 Head diameters biparietal, $10\frac{1}{2}$ cm , suboccipitobregmatic, $10\frac{1}{2}$ cm , bitemporal, $9\frac{1}{2}$ cm The babe now goes to the nursery

Note—The babe weighed $8\frac{1}{2}$ pounds

In this case I am confident we would have lost the child if delivery had been attempted before the pubiotomy was performed

The mother While waiting for the placenta we inspect the result of the delivery There is no tear vaginally The ends of the pubic bones are separated to the width of 2 fingers, but the chasm is still covered with mucous membrane and submucous tissue We now repair our episiotomy wound, bringing skin to skin, muscle to muscle, and mucous membrane to mucous membrane The placenta appears in the midst of our work and is properly received in a sterile basin The membranes follow We now finish the repair We place a couple of small sutures in the skin opening where the saw carrier went through and clean up the patient With a pad in the vulva the back is carefully dried She is placed on clean linen and a broad adhesive strip, at least 3 inches wide is carried entirely around the pelvis between the trochanters and the crests of the ilia The woman is now taken to her room and put upon a fracture bed The after treatment presents no particular complications as a rule In twelve hours the patient may be turned on her side and on the third day she may move herself

This operation has many advantages over the more serious operation of cesarean section The mortality for mother and babe is less The prostration afterward is not so severe It can be done or not done as may be decided after the first stage of labor The mortality in the case of the mother is about 2 per cent or very nearly that of a normal labor, while that of the babe is 4 per cent in selected puerperal cases with favorable conditions It is to be noted that the puerperium is usually pyrexial, but rarely high This is probably due to the absorption from the wounds in the mucous membrane The late results are good Union is fibrous in most cases and leaves a permanent enlargement of

pubiotomy provide. With considerable difficulty the arm is dislodged and swung forward. We are careful again as you see to keep the thumb on the child's back, so it is practically impossible to give a false direction to the arms as they are brought down. They are not pulled down but wiped over the face and chest of the child. Now with the assistant making compression on the head from above I extract. The child is placed astride the left arm and two fingers of the left hand are inserted in the mouth to maintain flexion and with the first and second fingers of the right hand over the child's neck from behind and across the shoulders I make traction in the so-called Smellie Veit



Fig. 34 The effect of pubiotomy. The dotted line represents the symphyseal line of the pelvis before division of the bone.

maneuver. The head delivers. The child as you see is a female large and strong. She has met no serious trauma in delivery and therefore cries at once and lustily. As soon as the child has cried the lungs have obtained all possible blood and the cord can be cut. The Pettit clamp which we use in these cases has been used for the last five years in this clinic with great satisfaction. We find it clean and easy to sterilize. It is easy to remove and devoid of danger. A 1 per cent solution of silver nitrate is now dropped into each eye. A tape with a number corresponding to the one placed on the mother's arm is now put on the child's wrist for the purpose of identification. The child is measured and confirms the antepartum estimate of

primipara, thirty five years old, and the babe lay in an occipito-left anterior position, the pelvis was flat. After complete dilatation of the os the head beat against the pubic arch for four hours without engagement and the question of a cesarean operation or a pubiotomy was urgent. The latter was decided upon and performed. The babe delivered safely and easily with forceps. The same careful technic was observed which you have seen before you today. At the conclusion of the operation no laceration of the soft parts intraperitoneally was observed. At the end of twelve hours the woman was catheterized and 30 ounces of urine obtained. Twenty four hours later the bladder began to leak through the vagina. Examination revealed a large opening, irregular in shape, which kept the bladder entirely drained. Whether this opening resulted from a tear during delivery which had been kept occluded by swelling of the soft parts and by the packing or whether it was due to necrosis of the tissue by the pressure of the child's head, we are unable to say. At any rate, a vesicovaginal fistula formed for which an operation will be necessary. It has been our experience that every primipara of thirty years of age or more in whom many pregnancies are not possible, and even the one which we are attending which has been a long time awaited, will prefer almost any form of pelvic or tissue mutilation rather than take a chance on the loss of the child. We agree with them in this, and find the pubiotomy a fairly beneficent operation for these cases. It saves many children.

We do not feel that pubiotomy in any way competes with cesarean section. It competes only with symphysiotomy, or the division of the pubic bones at the symphysis. In this clinic we feel that pubiotomy has been the safer. It makes a cleaner wound and the wound heals with fewer complications and generally with a permanent enlargement of the pelvis. Furthermore, the danger to the bladder and urethra during operation is distinctly less. The sole advantage of symphysiotomy is that it can be done with a scalpel, no saw or needle carrier being required.

As to the conditions for operation, we might say that the

the pelvic ring, so that subsequent labors are not infrequently normal. The gain in the true conjugate is about 0.75 cm., but there is a general increase in all dimensions which makes this diameter seem even larger. The operation is regarded in this clinic as quite ideal for pelvis measuring over $7\frac{1}{2}$ cm and in all cases of spatial disproportion on the part of the pelvis or child where cesarean section is not absolutely indicated. In some clinics it is not unusual to do this operation and allow the woman to deliver spontaneously, but here we believe that the woman should be allowed to continue her labor until the soft parts have reached the maximum degree of expansion and then when the operation is performed the child may be extracted immediately. As the operation increases the anteroposterior diameter by 0.75 cm. it is an ideal operation in cases where forceps have failed and where it is certain that a little more room will allow the head to pass. Of course, in breech cases a delay of more than eight minutes is not possible with safety to the child, and hence the desirability of having the saw in place before extraction is begun.

As to operations, the subcutaneous method has a facile technic, more satisfactory, at least in this clinic, than the Bumm operation. A minor difficulty is met with occasionally in passing the needle behind the pubic bone, but this is obviated by passing the finger into the vagina where the end of the needle carrier can be controlled. The principal danger of pubiotomy comes from the proximity of the large veins that lie in the base of the bladder. The wounding of these veins results in the formation of a large hematoma, which appears under the vaginal mucosa and may require digital compression or packing for a short time to secure hemostasis. Occasionally—rarely—extraction tears take place in the vaginal wall up to and even through the pubiotomy wound. Suppuration may follow. Packing seems to be all that is necessary in these cases and the results are generally quite satisfactory. Again, during extraction tears may take place in the vaginal walls up to the urethra or bladder and even through them. We had such an experience on the 19th of November last. The woman was a

primipara, thirty five years old, and the babe lay in an occipito-left anterior position, the pelvis was flat. After complete dilatation of the os the head beat against the pubic arch for four hours without engagement and the question of a cesarean operation or a pubiotomy was urgent. The latter was decided upon and performed. The babe delivered safely and easily with forceps. The same careful technic was observed which you have seen before you today. At the conclusion of the operation no laceration of the soft parts intraperitoneally was observed. At the end of twelve hours the woman was catheterized and 30 ounces of urine obtained. Twenty four hours later the bladder began to leak through the vagina. Examination revealed a large opening irregular in shape, which kept the bladder entirely drained. Whether this opening resulted from a tear during delivery which had been kept occluded by swelling of the soft parts and by the packing or whether it was due to necrosis of the tissue by the pressure of the child's head, we are unable to say. At any rate a vesicovaginal fistula formed for which an operation will be necessary. It has been our experience that every primipara of thirty years of age or more in whom many pregnancies are not possible, and even the one which we are attending which has been a long time awaited, will prefer almost any form of pelvic or tissue mutilation rather than take a chance on the loss of the child. We agree with them in this, and find the pubiotomy a fairly beneficent operation for these cases. It saves many children.

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As to the conditions for operation, we might say that the

pelvis must be larger than $7\frac{1}{2}$ cm c. v. that the child should be living and viable and the soft parts distensible and good surgical environment is prerequisite. The indication for this operation is that it should be preliminary to extraction by breech or forceps when disproportion exists between the head and the pelvis. To us it seems particularly indicated also in such malpositions of the head as face, brow, or posterior parietal bone.

Note—The patient walked on the eighteenth day and left the hospital on the twenty first.

